United States Air Force
11th Air Control Wing
11th Civil Engineering Operations Squadron

11TH AIR CONTROL WING

Elmendorf AFB, Alaska

FINAL

Indian Mountain LRRS, Alaska

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORK PLAN

JULY 1994

By:

JE
JACOBS ENGINEERING GROUP INC.
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PREFACE

This Remedial Investigation/Feasibility Study Work Plan describes the requirements for the expected tasks and activities needed to complete the investigation activities at Indian Mountain Long Range Radar Station according to the requirements of Contract No. F41624-94-D-8046, Delivery Order 4, between the U.S. Air Force and Jacobs Engineering Group Inc. It was developed to make certain that all environmental data generated for the project are scientifically valid, defensible, comparable, and of known and acceptable precision and accuracy. The SAP has been prepared in accordance with format and content requirements, as applicable, of the *Handbook to Support the Installation Restoration Program Statements of Work* prepared by the Air Force Center for Environmental Excellence (AFCEE), Brooks AFB, dated September 1993.

The Jacobs Engineering Group Inc. Project Manager for this contract is Ms. Lynn Schuetter. The Contracting Officer Representative for the AFCEE is Mr. Mike McGhee.

Approved:

for Robert Siek
Program Manager

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The remedial investigation (RI)/feasibility study (FS) will investigate sources at both the Upper Camp and Lower Camp, as well as assess the potential for migration of contaminants from the sources. Media to be sampled include surface water, surface soil, subsurface soil, sediment, and groundwater. Field screening techniques will be used, as well as the services of offsite laboratory. Following completion of the RI, data will be evaluated, an RI/FS report and decision documents will be prepared.

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NOTICE

This report has been prepared for the U. S. Air Force by Jacobs Engineering Group Inc. for the purpose of aiding in the implementation of a final remedial action plan under the Air Force Installation Restoration Program (IRP). As the report relates to actual or possible releases of potentially hazardous substances, its release before an Air Force final decision on remedial action may be in the public's interest. The limited objectives of this report and the ongoing nature of the IRP, along with the evolving knowledge of site conditions and chemical effects on the environment and health, must be considered when evaluating this report, since subsequent facts may become known which may make this report premature or inaccurate. Acceptance of this report in performance of the contract under which it is prepared does not mean that the Air Force adopts the conclusions, recommendations or other views expressed herein, which are those of the contractor only and do not necessarily reflect the official position of the United States Air Force.

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LIST OF ACRONYMS

ABAL	Areas Below Action Levels
AC&W	Aircraft Control and Warning Facility
ACEC	Area of Critical Environmental Concern
AD	Anno Domini
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
AFB	Air Force Base
AFCEE	Air Force Center for Environmental Excellence
Air Force	U.S. Air Force
AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirement
ASTM	American Society for Testing and Materials
BC	Before Christ
BCA	Brown and Caldwell Analytical
BLM	U.S. Bureau of Land Management
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CEC	Cation Exchange Capacity
CEOS	Civil Engineering Operations Squadron
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
CSM	Conceptual Site Model
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethene
DDT	Dichlorodiphenyltrichloroethane
DEQPPM	Defense Environmental Quality Program Policy Memorandum
DOD	U.S. Department of Defense
DQO	Data Quality Objective
DRMO	Defense Reutilization and Marketing Office
DRO	Diesel-range Organics
DTIC	Defense Technical Information Center
EPA	Environmental Protection Agency
ES	Engineering Science Inc.
FS	Feasibility Study

LIST OF ACRONYMS

FSP	Field Sampling Plan
FWS	U.S. Fish and Wildlife Service
GC	Gas Chromatograph
GFAA	Gas Furnace Atomic Absorption
GRO	Gasoline-range Organics
HMP	Habitat Management Plan
HSP	Health and Safety Plan
ICP	Inductively Coupled Plasma
IDW	Investigation-Derived Waste
IRP	Installation Restoration Program
IRPIMS	Installation Restoration Program Information Management System
ITIR	Informal Technical Information Report
Jacobs	Jacobs Engineering Group Inc.
JEMS	Jacobs Environmental Management System
kg	Kilogram
l	Liter
LRRS	Long Range Radar Station
m^3	Cubic Meter
mg	Milligram
mogas	motor fuels
MS	Mass Spectrometer
NCP	National Oil and Hazardous Substances Contingency Plan
NDB	Nondirectional Beacon
NFRAP	No Further Response Action Planned
NOAA	National Oceanic and Atmospheric Administration
NTIS	National Technical Information Service
OSHA	Occupational Safety and Health Administration
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
PFS	Preliminary Feasibility Study
PID	Photoionization Detector
POL	Petroleum, Oil, and Lubricants
ppb	Parts per Billion
ppm	Parts per Million

LIST OF ACRONYMS

PRG	Preliminary Remediation Goal
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RRO	Residual-Range Organics
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act (1986)
SI	Site Investigation
SVOC	Semivolatile Organic Compounds
TAL	Target Analyte List
TBC	To Be Considered
TCLP	Toxicity Characteristic Leaching Procedure
TPH	Total Petroleum Hydrocarbons
USGS	U.S. Geological Survey
VOC	Volatile Organic Compounds
W-C	Woodward-Clyde Consultants, Inc.
WACS	White Alice Communications System
^{o}F	Degrees Fahrenheit
$\mu g/kg$	Micrograms per Kilogram

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1.0 INTRODUCTION

This Remedial Investigation(RI)/Feasibility Study (FS) Work Plan, prepared by Jacobs Engineering Group Inc. (Jacobs), provides information on proposed activities associated with a remedial investigation at the Indian Mountain Long Range Radar Station (LRRS) in Alaska (Figure 1.0-1). The Work Plan provides the rationale for the proposed environmental sampling program, the data needs and uses, and the overall objectives for the project. The plan is based on the identification of potentially contaminated areas through previous studies, as well as intensive literature reviews conducted as part of the Work Plan preparation. (See Section 1.2.) The plan was prepared based on guidance found in the *Handbook to Support Installation Restoration Program Remedial Investigations and Feasibility Studies* (U.S. Air Force [Air Force] 1993a).

This investigation is part of a larger program, designed to evaluate potential hazardous waste contamination at Air Force facilities, known as the Installation Restoration Program (IRP). Because of its primary mission in national defense, the Air Force has long been engaged in a wide variety of operations that involve the use, storage, and disposal of hazardous materials. In 1980, the U.S. Department of Defense (DOD) developed the IRP to investigate hazardous material disposal sites on DOD facilities, as discussed in Section 1.1.

The Work Plan has six sections. Section 1.0 provides background information on the Air Force IRP and its objectives, previous IRP work performed at Indian Mountain LRRS, and the objectives of the current investigation. Section 2.0 provides a summary of the environmental setting, the current knowledge of Indian Mountain LRRS, and the data needs for the RI. Section 3.0 describes the purpose, objectives and rationale for the field investigation approach. Section 4.0 presents reporting and data management requirements. Section 5.0 is the anticipated schedule for the investigation. Section 6.0 presents the references used to prepare the Work Plan.

1.1 THE AIR FORCE INSTALLATION RESTORATION PROGRAM

The objectives of the Air Force IRP are to assess past hazardous waste disposal and spill sites at Air Force installations and develop remedial action consistent with the National Oil and Hazardous Substances Contingency Plan (NCP) for those sites that pose a threat to human health and welfare or the environment. The following sections present information on the program origins, objectives, and organization.

1.1.1 Program Origins

The Resource Conservation and Recovery Act (RCRA) of 1976, as amended, is one of the primary federal laws governing the disposal of hazardous wastes. Sections 6001 and 6003 of RCRA require that federal agencies comply with local and state environmental regulations and provide information to the U.S. Environmental Protection Agency (EPA) concerning past disposal practices at federal sites. Section 3012 of RCRA requires state agencies to inventory past hazardous waste disposal sites and provide information to EPA concerning those sites.

In 1980, Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLA, also known as Superfund, outlines the responsibility for identifying and remediating contaminated sites in the

United States and its possessions. CERCLA legislation identifies EPA as the primary policy and enforcement agency regarding contaminated sites.

Executive Order 12372, which was adopted in 1981, gave various federal agencies, including DOD, the responsibility to act as lead agencies to conduct investigations and implement remediation efforts when they are the sole contributor to contamination on or off their properties.

The Superfund Amendments and Reauthorization Act (SARA), enacted in 1986, extends the requirements of CERCLA, and modifies CERCLA with respect to goals for remediation and the process leading to the selection of a remedial action. Under SARA, technologies that provide permanent removal or destruction of a contaminant are preferable to action that only contains or isolates the contaminant. SARA also provides for greater interaction with public and state agencies and extends EPA's role in evaluating health risks associated with contamination. Under SARA, early determination of Applicable or Relevant and Appropriate Requirements (ARARs) is required, and consideration of potential remediation alternatives is recommended at the initiation of an investigation. SARA is the primary legislation governing remedial action at past hazardous waste disposal sites.

The IRP was implemented to identify potentially contaminated sites, investigate those sites, and evaluate and select remedial actions for potentially contaminated facilities. The DOD issued the Defense Environmental Quality Program Policy Memorandum (DEQPPM) 80-6 regarding the IRP in June 1980. The NCP was issued in 1980 to provide guidance on a process by which contaminant releases could be identified and quantified and remedial actions selected. The NCP describes the responsibilities of federal and state governments and the parties responsible for contaminant releases.

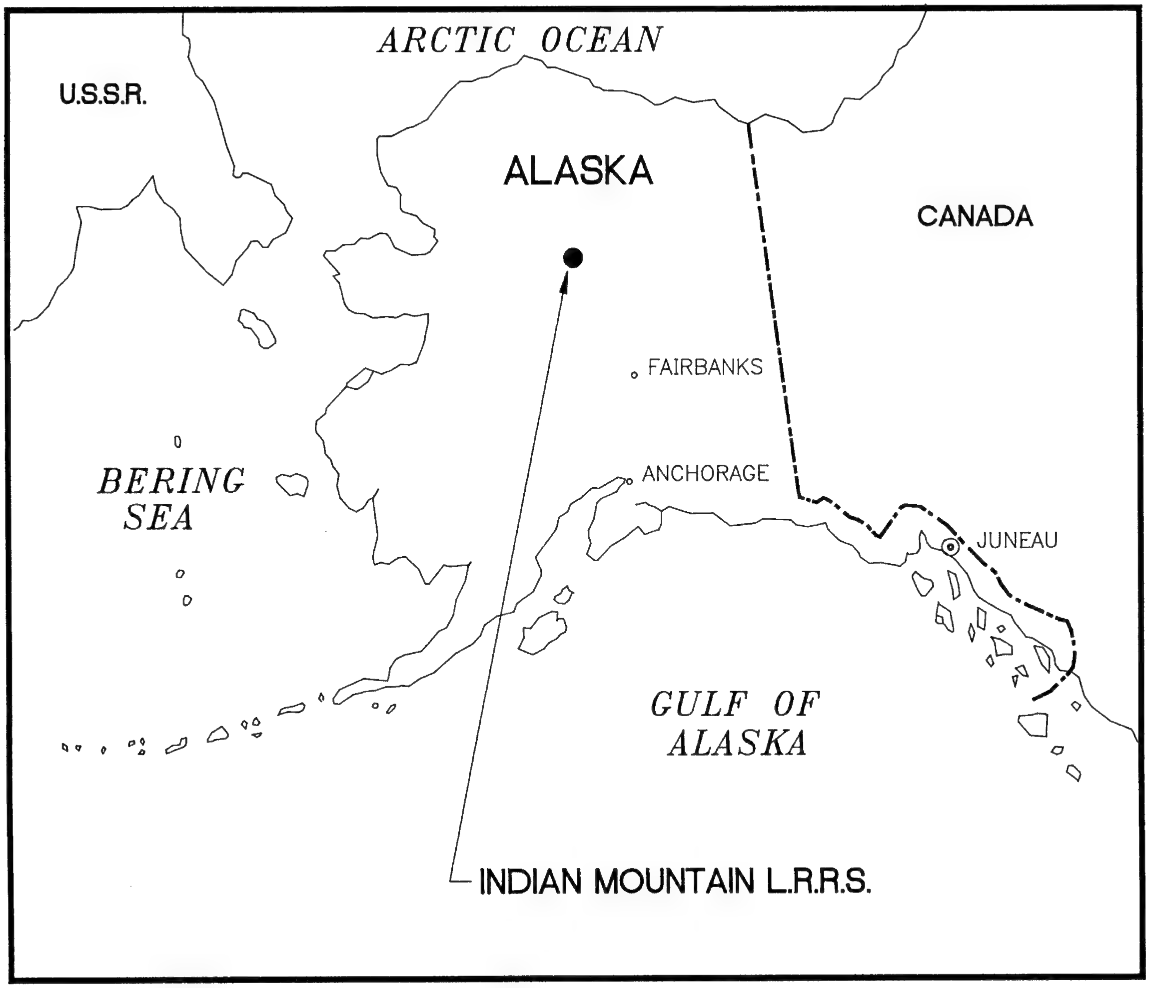
DOD formally revised and expanded the existing IRP directives, and amplified all previous directives and memoranda concerning the IRP, through DEQPPM 81-5, dated 11 December 1981. This memorandum was implemented by an Air Force message dated 21 January 1982.

1.1.2 Program Objectives

The objectives of the IRP include the following:

- Identify and evaluate sites where contamination may be present on DOD property because of past hazardous waste disposal practices, spills, leaks, or other activities.
- Control the migration of hazardous contaminants.
- Control health hazards or hazards to the environment that may result from past DOD disposal operations.

The IRP was developed so that these objectives could be met in accordance with the NCP, CERCLA, and SARA. Solutions that are developed must protect public health and the environment, meet ARARs, and be technically feasible to implement at the evaluated site.



LOCATION MAP

MAGNETIC DECLINATION : 24° 42'
ANNUAL RATE OF CHANGE : 4.1'
U.S.G.S. EPOCH 1985

LEGEND

⊙ CAPITAL

INDIAN MOUNTAIN
LONG RANGE RADAR STATION
LOCATION MAP

PROJ. MGR.	ACAD FILE NO.	FIGURE NO.	
L.SCHUETTER	FIG1_0-1	1.0-1	
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To meet these objectives, the following program tasks will be completed:

- Develop a project database through literature search, field investigation, laboratory analysis, and data evaluation.
- Develop and implement a quality assurance (QA)/quality control (QC) program to ensure meaningful and defensible data.
- Develop and follow site and laboratory safety plans to protect the health and safety of personnel and to prevent the release of contaminants.
- Identify data gaps and recommend and implement appropriate additional or supplemental studies during the course of performing the RI/FS.
- Use a rigorous procedure to identify, evaluate, and select appropriate solutions.
- Conduct the IRP in compliance with applicable federal, state, and local regulations and guidances.
- Provide information regarding the nature and extent of identified contamination, the effects of contamination on the community, the progress of the IRP, and the selected remedial alternative and its impacts on human health and environment.
- Develop a community relations program to provide information to the local community and other interested parties on the progress of the IRP.

1.1.3 Program Organization

Originally, IRP studies were organized into four phases: Phase I - Installation Assessment/Records Search; Phase II - Confirmation/Quantification; Phase III - Technology Base Development; and Phase IV - Remedial Actions. The phases of the Air Force IRP were sequential steps as compared with the steps of the Superfund remedial process, which can take place simultaneously. Although the procedures were different, the targets of the two programs were the same. In response to SARA and for the Air Force program to parallel the Superfund process, DOD directed the Air Force to implement the RI/FS methodology of conducting the IRP.

1.2 HISTORY OF INSTALLATION RESTORATION PROGRAM WORK AT INDIAN MOUNTAIN LRRS

Previous IRP activities at Indian Mountain LRRS were presented in the following reports:

- Phase I, Records Search Report (Air Force 1985)
- Phase II, Stage 1 Confirmation/Quantification Report (Air Force 1989)
- *Installation Restoration Program Remedial Investigation/Preliminary Feasibility Study, Stage 2* (Air Force 1991)
- *Final Site Investigation Report, Indian Mountain LRRS, Alaska* (Air Force 1993b)

1.2.1 Installation Description

Indian Mountain LRRS consists of an Upper Camp, where radar facilities are located, and a Lower Camp, where residential and support facilities are located. The following sections describe the physical setting and history of the Upper Camp and Lower Camp.

1.2.1.1 <u>Upper Camp</u>

The Upper Camp is located at the summit of Indian Mountain at an elevation of approximately 4,200 feet. A radar dome and a small building for a backup generator are currently the only structures existing at Upper Camp. Older facilities at Upper Camp were demolished and buried in 1986.

The Upper Camp area is characterized by steep slopes of fractured bedrock overlain in places by a thin layer of sand, gravel, cobbles, and boulders. Below the summit and above the 4,000-foot elevation, flat areas are overlain with up to several feet of soil and vegetation. The distribution of permafrost in the Upper Camp area is undefined, although there is indirect evidence that permafrost is both deep and extensive on the north facing slopes.

The site of the Upper Camp consists of two levels: an upper bench and a lower bench. Before the demolition work in 1986, the majority of the Upper Camp facilities, including all the buildings, were located on the upper bench. The present radar dome and generator building are located on the upper bench.

The lower bench is adjacent to the upper bench on the north and east sides, separated by a 30- to 50-foot high escarpment. Petroleum, oil, and lubricants (POL) storage tanks, a POL pump house, water tanks, and a used drum storage yard were once located on the lower bench.

When the Upper Camp structures were demolished in 1986, the resulting debris was buried in landfills located on both benches. The exact locations and number of these landfills is unknown. The radar dome was left standing and operable, and the remainder of the site was leveled and graded. As-built drawings of the Upper Camp before demolition show that the elevation at the base of the radar dome was approximately the same as that of the other buildings and structures on the upper bench. Now, the base of the radar dome sits approximately 5 feet above the elevation of most of the upper bench, indicating that a large amount of soil was removed from this bench during demolition. Another comparison of the predemolition as-built drawings and the present site conditions shows that an area north and east of the lower bench has received a large amount of fill. This evidence indicates that a portion of the debris was placed at the outside edge of the lower bench and covered with material obtained from the upper bench.

Most of the landscape within the vicinity of the summit, about 10 acres, has been disturbed by construction or demolition activities. Where undisturbed, the ground is typically tundra. The tundra consists primarily of sedges, very low willows, cranberry, mountain avens, cassiope, and lichens.

Several large spills or leaks, totalling over 60,000 gallons of diesel fuel, reportedly have occurred at the Upper Camp since records were kept beginning in the 1970s (Air Force 1985). A considerable percentage of the fuel was not recovered. Similar types of spills and leaks are likely to have occurred before the 1970s. Several

smaller 100- to 500-gallon spills of fuel, motor fuels (mogas), and waste oils have occurred. Oily wastes were typically applied to the roads for dust control. A waste accumulation area was located just northeast of and below the summit. This area was used for storing drummed waste products. Spills have occurred at this site. Landfills at the Upper Camp reportedly received scrap metal, wood, and other construction waste. A general cleanup of the site was conducted from 1978 to 1980 to crush and bury barrels and other debris in the landfills.

1.2.1.2 Lower Camp

The Lower Camp is located at the 1,000-foot elevation between the confluence of Indian River and Utopia Creek. Utopia Creek has been extensively mined by placer operations. Slopes to the north rise steeply to a high mountain ridge. Slopes to the west and south rise moderately on rounded hills. Fractured bedrock is exposed on the ridges and at higher elevations.

The Indian River flows toward the Lower Camp from the northeast and flows to the east below the camp. The gradient of the river in this vicinity is about 50 feet per mile.

Adjacent to the camp is a 4,300-foot gravel airstrip. An 8-mile gravel road is maintained to the Upper Camp. Unmaintained trails of varying trafficability extend beyond the camp.

Numerous documented leaks and spills of diesel fuel, totalling over 65,000 gallons, reportedly have occurred since records were kept beginning in 1973 (Air Force 1985). Recovery of fuel was estimated to be about 80 percent. Five former waste accumulation areas are located in the vicinity of the camp. Some contaminated soil was removed from these sites in 1984. Three of the four landfills are now generally covered with earth, and the fourth is still operating.

The geology of the Lower Camp area is dominated by recent alluvium deposited by Indian River and Utopia Creek. At the station water supply well adjacent to Indian River, the depth of alluvium is at least 25 feet. The alluvium is permeable and the groundwater level is shallow. The presence of permafrost is likely, but the thickness and extent are unknown. Permafrost was not encountered when the well was installed in the alluvium to a depth of 25 feet.

Much of the land at the Lower Camp is covered by species of poplar, black and white spruce, aspen, birch, and willow. Large areas in the valleys are covered with stands of willow or willow and white spruce. Less common are stands of poplar, aspen, or birch. Usually species of spruce are mixed in with these stands as well. The areas along the rivers that have been disturbed by changes in braided channels have become revegetated with willow. Other species of trees have developed in the area at varying intervals after disturbance, with poplar or birch coming well before the white spruce. Understory plants include dwarf birch, low willow shrubs, blueberries and cranberries, prickly rose, Labrador tea, and other berries. Low growing alder are found in the understory at a few locations along waterways and in other disturbed areas. A moss ground cover is often present.

The surrounding hills are predominantly covered with willow, either as trees or shrubs. Mixed stands of willow and white spruce are interspersed with a few aspen on south-facing slopes. Dwarf birch, Labrador tea, low willow, grasses, and sedges

form an understory. Blueberries and cranberries grow wherever there is sufficient room. The patchy ground cover consists of moss and lichen.

1.2.1.3 Past Waste Management Practices

A description of historical waste disposal practices is provided in this section. Greater detail is included in Section 2.2 for sites to be investigated as part of this RI/FS.

Liquid wastes have been generated at Indian Mountain LRRS by industrial operations such as power generation and vehicle maintenance. Lubricating oil and small amounts of solvents are the principal hazardous wastes produced. In the past, the petroleum-based wastes have been spread on the installation's extensive road system for dust control. This practice was discontinued in 1984. Presently, wastes are collected in drums at the accumulation area adjacent to the eastern end of the runway. Drums are stored there before being airlifted to the Elmendorf Air Force Base (AFB) Defense Reutilization and Marketing Office (DRMO) (Air Force 1991).

All fuel supplies for the installation are airlifted to the site. Liquid fuel is pumped directly from the supplying aircraft to POL storage tanks adjacent to the runway. Tank trucks are used to transport fuel from the tanks to the Upper Camp. Fuel leaks are monitored by inventory control, which has shown the fuel system to have considerable spill and leak problems. Inherent deficiencies in estimating spill volumes by the inventory control method may have resulted in inaccurate estimation of releases (Air Force 1991). A table listing major spills and leaks documented during the 1970s is included in Section 4 of the Phase I report (Air Force 1985).

Woodward-Clyde Consultants (W-C) described investigations at several waste accumulation areas and landfills in the Final Site Investigation Report (Air Force 1993b). The five waste accumulation areas were primarily used for liquid waste and drum storage. W-C referred to these as Waste Accumulation Area Nos. 1, 3, 4, 5, and 6; they are now designated SS02, SS09, LF06, SS03, and SS10, respectively. Four landfills were identified in the Phase I report (Air Force 1985) and investigated by W-C during their 1992 site visit (Air Force 1993b). W-C referred to these landfills as Landfill No. 1 (now designated LF04), Landfill No. 2 (now LF05), and Landfill Nos. 3 and 4 (now part of LF06). The period of time each landfill was in use, and the waste received, varied by location. Landfill LF05 is the active station landfill. The other landfills are no longer in use and each area has been graded.

1.2.2 Previous Investigative Activities and Documentation

The Phase I investigation report identified 11 sites, eight at the Lower Camp and three at the Upper Camp, as potential hazardous waste sites. These sites include the landfills and waste accumulation areas described above, dump areas, spill or leak areas, road oiling locations, and the White Alice Communications System (WACS) site (OT08). W-C performed the follow-on investigation during the summer of 1986 and presented findings in the Stage II report published in 1990 (Air Force 1991). Minor surface water contamination by petroleum hydrocarbons was detected in a pond on the lower bench of Upper Camp. The pond is fed by a seep between the upper and lower benches. Recommendations for additional characterization of the Upper Camp, specifically excavation of test pits, were made based on analytical results, visual observations, and data gaps identified (Air Force 1990).

The RI/Preliminary FS (PFS), Stage 2 (Air Force 1991) classified all of the sites in the Lower Camp, except the water supply well, as Category 1, requiring no further action. The State of Alaska did not accept the no further action recommendations. The effort described in this Work Plan is in response to the need for additional investigation. The water supply well was classified as high-priority Category 2 because of detection of 1 part per billion (ppb) of 1,1-dichloroethene, which exceeded State of Alaska Department of Environmental Conservation (ADEC) and EPA standards. The recommended action was verification by resampling.

To assess the effects of the reported spills at the Upper Camp, surface water and sediment samples were collected from drainages on the east side of Indian Mountain. Most of the surface runoff from the Upper Camp flows down the east side of the mountain. Elevated levels of petroleum hydrocarbons were found in water samples from three of the Upper Camp drainage sampling locations and in the sediment at a fourth location. Due to the presence of contamination, the Upper Camp summit area and drainage were recommended for further investigation and classified as high priority Category 2 (Air Force 1991).

Reportedly, SS02, SS09, and SS10 have been remediated by either removing stained soil and debris or by burying debris. These three areas have been graded and no stained soil was observed in 1992. SS03 is not mentioned in the Site Investigation Report (Air Force 1993b) although the Phase I report (Air Force 1985) stated that several barrels with oil were found at the area and adjacent to the road leading to the Upper Camp. Cleanup efforts have not been undertaken at LF06. No stained soil was observed at this area during the W-C 1992 visit, although numerous drums were present. Surface and subsurface soil samples were collected at the waste accumulation areas during the 1992 W-C site investigation (SI).

The four landfills were also investigated by W-C in 1992 (Air Force 1993b). Debris and soil staining were observed at LF06, and neither were reported for landfill LF04. Surface and subsurface soil samples were collected at each of the closed landfills. The waste accumulation areas, landfills, and other identified release areas were grouped into sources based on location and are described in Section 2.2.

1.2.3 Previous Remedial Actions

Fuel recovery from documented spills and some soil removal at Lower Camp constitute informal remedial activities at Indian Mountain LRRS. IRP remedial activities have not been undertaken at Indian Mountain LRRS.

1.3 DESCRIPTION OF CURRENT STUDY

The following sections describe the current technical effort, including the objectives of the 1994 field effort, preparation of planning documents, and selection and supervision of subcontractors.

1.3.1 Project Objectives

The activities described in this plan will be performed to fulfill the RI requirements set forth by EPA guidance (EPA 1988) and the Indian Mountain LRRS Statement of Work. The RI will assess environmental conditions, the nature and extent of contamination, and estimate the risk to human health and the environment at various sites through the collection of geological, geophysical, hydrogeological, chemical, physical, and environmental samples. After laboratory analysis of these

samples for potential contaminants, the validated analytical results and field measurements will be evaluated. The purpose of the above activities is to determine whether installation-related contaminants have entered the environment and present a risk to human health or the environment. The sources of previously identified contaminants will be determined and the measured concentrations compared with ARARs and any naturally occurring or background concentrations for specific compounds. The RI shall comply with the specifications, procedures, and methodologies presented in the Sampling and Analysis Plan (SAP).

Additional project tasks include completion of an FS, conceptual site model, a qualitative baseline risk assessment, remedial alternative development and analysis, and an administrative record.

1.3.2 Scoping Documents

In addition to this Work Plan, a SAP and a Health and Safety Plan (HSP) have been prepared as companion documents.

The SAP includes two main sections: a Quality Assurance Project Plan (QAPP) and a Field Sampling Plan (FSP). The QAPP, Section 1.0 of the SAP, outlines the following quality requirements for the project:

- data quality objectives (DQOs) for data collection;
- analytical procedures;
- sample handling and custody procedures;
- calibration procedures;
- data reduction, validation, and reporting procedures;
- internal QC checks for field and laboratory operations;
- performance and system audits;
- procedures to assess data precision, accuracy, and completeness;
- corrective actions; and
- QA reports.

The FSP details all sample collection procedures, including sampling for soil gas, surface water, groundwater, surface soil, subsurface soil, and sediment. Also described are procedures for site reconnaissance, geologic mapping, borehole drilling, installation of monitoring wells, aquifer testing, surveying, and waste handling. The FSP includes a discussion of the field QA/QC program, record keeping procedures for field activities, and site management. The FSP is Section 2.0 of the SAP.

The HSP includes all procedures to be followed in the field to ensure the health and safety of all field personnel and to prevent the inadvertent release of contaminants into the environment. A description of possible contaminants of concern along with their respective health risks is included. Accident reporting procedures and medical evacuation procedures are components of the HSP.

1.3.3 Subcontractors

The following sections describe the types of subcontracts that will be required for the Indian Mountain LRRS field investigations.

1.3.3.1 Laboratories

Jacobs will subcontract Brown and Caldwell Analytical (BCA) Laboratories, located in Glendale, California, to provide analytical services.

The process used by Jacobs to select this laboratory included review of the laboratory QAPP, Statement of Qualifications, most recent Air Force Center for Environmental Excellence (AFCEE) audit report, most recent EPA Performance Evaluation sample results (Water Pollution and Water Supply), and any associated corrective actions.

Sample locations requiring analytical results for site characterization and risk assessment purposes will be analyzed by BCA in Glendale, CA. Laboratory capacity and capabilities have been reviewed by Jacobs personnel. The project QA coordinator will ensure that all analytical work performed by BCA complies with the project-specific requirements and the Air Force IRP Handbook (Air Force 1993a). Appendix A of the SAP lists the deliverables that will be provided by the laboratory to comply with the required analytical quality level. The chemical analyses to be performed by BCA will include the following:

Parameter	Method	Medium
Volatile Organic Compounds (VOCs)	SW8240 SW8260	Soil Water
Semivolatile Organic Compounds (SVOCs)	SW8270	Soil, Water
Inductively Coupled Plasma (ICP) Metals	SW6010	Soil, Water
Organochlorine Pesticides and Polychlorinated Biphenyls (PCBs)	SW8080	Soil, Water
Gasoline-Range Organics (GRO)	SW8015 (Alaska Modified)	Soil, Water
Diesel-Range Organics (DRO)	SW8100 (Alaska Modified)	Soil, Water
Residual-Range Organics (RRO)	AK103	Soil
Arsenic by Gas Furnace Atomic Absorption (GFAA)	SW7060	Water
Lead by GFAA	SW7421	Water
Cadmium by GFAA	SW7131	Water
Chromium by GFAA	SW7191	Water
Mercury by Cold Vapor	SW7470 SW7471	Water Soil

Common Anions	SW9056	Water
Total Organic Carbon	SW9060	Soil

Toxicity characteristic leaching procedure (TCLP), Federal Regulation Volume 55, Number 61, 29 March 1990 (Extraction Method 1311):

- VOCs, SW8240;
- SVOCs, SW8270;
- Organochlorine pesticides and PCBs, SW8080;
- Arsenic, SW7060;
- Barium, SW7080;
- Cadmium, SW7130;
- Chromium, SW7190;
- Lead, SW7420;
- Mercury, SW7470;
- Selenium, SW7740; and
- Silver, SW7760.

The following geotechnical analyses will be performed by Kleinfelder, a subcontractor to BCA, and will be reported by BCA:

- soil cation exchange capacity (CEC), SW9081;
- determination of water content, American Society for Testing and Materials (ASTM) D2216;
- grain size analysis, ASTM D422;
- specific gravity, ASTM D854; and
- vertical permeability, ASTM 2434.

1.3.3.2 Other Subcontractors

Data Validation. Five percent of data generated by BCA will undergo data validation equivalent to EPA Contract Laboratory Program (CLP) Level IV. In addition to the review of data summary forms, this type of validation includes a review of the raw data. For example, validation would include an examination of actual gas chromatograph (GC)/mass spectrometer (MS) analyses to ensure that compounds were identified properly and calculations performed correctly. The 5 percent of project data that will undergo this more rigorous validation will be selected by the project QA coordinator. Selection will be based on how critical the sample location is and the representativeness of the analyses.

Data validation will be conducted by QuantaLex, Inc., located in Lakewood, Colorado. Data validation will be performed in accordance with the Air Force IRP Handbook (Air Force 1993a) and EPA guidance. Those analyses not within the scope of the national functional guidelines will be validated using protocols identified by the data validation firm. All analytical methods identified in the SAP will be validated. Appendix B of the SAP contains a brief description of the scope of work for data validation.

Drilling. Drilling services will be provided by the 11th Civil Engineering Operations Squadron (CEOS). The 11th CEOS will provide the following:

- all drilling equipment, to include hollow-stem auger, auger flights, protection gear for the 11th CEOS personnel, support vehicles, diesel fuel, and associated labor;

- all drilling equipment and labor required for monitoring well construction and development;

- all equipment necessary to decontaminate the drilling rig and its accessories and all drilling materials such as casing, excluding supplies or equipment necessary for decontaminating sample collection equipment;

- Occupational Safety and Health Administration (OSHA)-certified and qualified crew to decontaminate drilling rig and drilling materials, install and develop monitoring wells, and drill soil boreholes; Jacobs will be responsible for collecting soil and water samples, and for purging monitoring wells before sample collection;

- drums to collect potentially hazardous material, and transportation of contained hazardous material to the holding area designated by Indian Mountain LRRS;

- transportation of investigation-derived waste (IDW) characterized as hazardous from Indian Mountain LRRS to Elmendorf AFB; and

- transportation of all government drilling equipment and materials to and from Indian Mountain LRRS; the Air Force will also transport all contractor-supplied equipment and materials to and from Indian Mountain LRRS on a one-time basis each way.

Surveying. Surveying well and borehole locations will be performed by a State of Alaska registered surveyor, who will be provided by the 11th CEOS. Surveying will be conducted in accordance with procedures outlined in the Air Force IRP Handbook (Air Force 1993a). All locations will be surveyed with a vertical accuracy of at least 0.01 foot. Horizontal accuracy for a third-order Class I survey, as specified by the Air Force IRP Handbook, is specified to be 1 part in 10,000. Vertical accuracy for a third-order Class I survey is specified to be 2.0 millimeters multiplied by the square root of K, where K is the distance between adjacent points in kilometers. The absolute value of accuracy is relative to the distance between survey points. For example, the horizontal and vertical accuracy for adjacent points 1 mile apart would be 0.53 feet and 0.008 feet, respectively, while the horizontal and vertical accuracy for adjacent points 1,000 feet apart would be 0.10 feet and 0.004 feet, respectively.

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2.0 SUMMARY OF EXISTING INFORMATION

This section provides a background literature review of available documents, maps, and photographs. The information includes descriptions of the environmental setting of Indian Mountain LRRS, conceptual site models for both Upper Camp and Lower Camp, data needs, ARARs, and remedial actions implemented to date.

2.1 INDIAN MOUNTAIN LRRS ENVIRONMENTAL SETTING

Indian Mountain was named by a U.S. Geological Survey (USGS) geologist, H.M. Eakin, in 1913 after the nearby Indian River. An earlier native name for the mountain was Batzatgla, meaning obsidian hill.

Construction of the Indian Mountain radar facilities began in late 1952. The station was constructed as two separate camps. Lower Camp was located adjacent to the Indian River because the terrain was suitable for siting a landing strip. Personnel quarters and maintenance and support facilities are located in Lower Camp. Lower Camp is located on what is believed to be the site of the 1900s gold mining town of Utopia Creek. The elevation of Lower Camp is just over 1,000 feet. The Lower Camp airstrip is sloped with elevations ranging from approximately 1,000 feet at the east end to over 1,300 feet at the west end.

Upper Camp is located at the summit of Indian Mountain at an elevation of 4,234 feet, approximately 8 road miles north of Lower Camp. The radar facilities are located at Upper Camp.

2.1.1 Demography

Currently seven people are assigned to Indian Mountain LRRS. These people are employees of Martin Marietta Services, Inc. under contract to the Air Force to operate and maintain the radar installation and the associated facilities.

The station, located 168 miles northwest of Fairbanks, is accessible only by air.

The nearest community is Hughes, located approximately 18 miles northwest of the site. Hughes has a population of 91. In 1987 (Alaska Municipal Officials Directory 1991), there were only three nonnative residents in Hughes. The local economy in Hughes is heavily dependent on both government spending and on a subsistence lifestyle. Seasonal employment is provided by fire fighting, local construction, and mining.

The present site of Hughes was used as a trade center by native people before its formal founding in 1910. From 1910 until 1915, Hughes served as a riverboat landing and supply port for the Indian River goldfields. After 1915, the local mining industry declined, and the Hughes trading post became the center of what then became a Koyukon-Athabascan Indian village.

Hughes is a second-class city with a post office, telephone service, school, health clinic and air service. The Public Health Service provides the community water system with a well and pumphouse (Air Force 1991).

Indian Mountain is located in an area of placer gold mining, and there are six mining related cabin sites within four miles of Lower Camp. The cabins are only occupied on a temporary basis due to the seasonal nature of the gold placer mining activities.

It has been estimated that up to 12 individuals may be involved in placer mining operations, but this probably varies from season to season (U.S. Army Corps of Engineers undated)

2.1.2 Geology

The Indian Mountain LRRS is located within the central Koyukuk River region of west-central Alaska. This region, which covers an area of 6,600 square miles, covers portions of the Hughes, Melozitna and Shungnak USGS 1:250,000-scale quadrangles.

The earliest geologic mapping in the region was done primarily along the Koyukuk River by Schrader (1900, 1904). Later mapping of parts of the region and of contiguous areas of interest was done by Smith (1913), Eakin (1916), and Fernald (1964). The most recent mapping, by Patton and Miller (1966) and Patton et al. (1968, 1978) includes the Hughes, Shungnak, Melozitna and a part of the Ambler River USGS 1:250,000-scale quadrangles. The relationship of ore deposits to geology was studied by Miller and Ferrians (1968).

2.1.2.1 Regional Geology

The bedrock of the central Koyukuk River region consists chiefly of granitic rocks intruded during two late Mesozoic plutonic episodes into marine andesitic volcanic rocks, volcanic graywacke, and mudstone of older Mesozoic era. Quartz latite volcanics were extruded between the intrusive episodes, and fine-grained felsic intrusives of the Late Cretaceous or Early Tertiary periods occur near Indian Mountain. Hydrothermal mineralization, which introduced gold, silver, copper, lead, zinc, and molybdenum, appears to have been associated genetically with the granitic intrusions. Most mineralized areas in the region occur along or near the contacts between the late Mesozoic plutons and country rock.

The region lies along the Hogzata Arch, which is described by Miller et al. (1959) as a linear structural high extending from the northeast end of the Seward Peninsula to the Koyukuk River. The rocks of the region have been deformed into broad, gentle to moderate folds and are broken by a complex fault system. The structural fabric is roughly east-west for the central and western part of the region and northeast-southwest for the eastern part.

Lowland areas in the region are underlain by unconsolidated deposits in contrast to the mountainous areas and adjacent uplands, that are underlain by bedrock. Most of the Koyukuk Flats, in the southwestern part of the region is underlain by fine-grained, water-laid, and windborne sediment of Pleistocene and Holocene epochs (Miller and Ferrians 1968).

The lowlands in the northern part of the region, including the area north of Indian Mountain, and adjacent uplands are underlain by glacial drift and till of the Pleistocene epoch (Coulter et al. 1965), that was deposited by large piedmont glaciers originating in the Brooks Range to the north. Illinoian glaciation (starting approximately 115,000 years ago) was more extensive than that of the later Wisconsin (approximately 70,000 to 10,000 years ago) (Coulter et al. 1965). Local alpine glaciers emanated from higher elevations, including the Indian Mountains, during Pleistocene time and deposited glacial drift in the valleys.

This region is within the zone of permafrost (Figure 2.1-1). Permafrost is capable of profoundly modifying groundwater flow systems. Frozen ground can be an impermeable layer that has the following characteristics:

- restricts recharge, discharge, and migration of groundwater;
- acts as a confining layer; and
- limits the volume of unconsolidated deposits and bedrock in which liquid water may be stored.

Permafrost is described at length because permafrost is present at Indian Mountain.

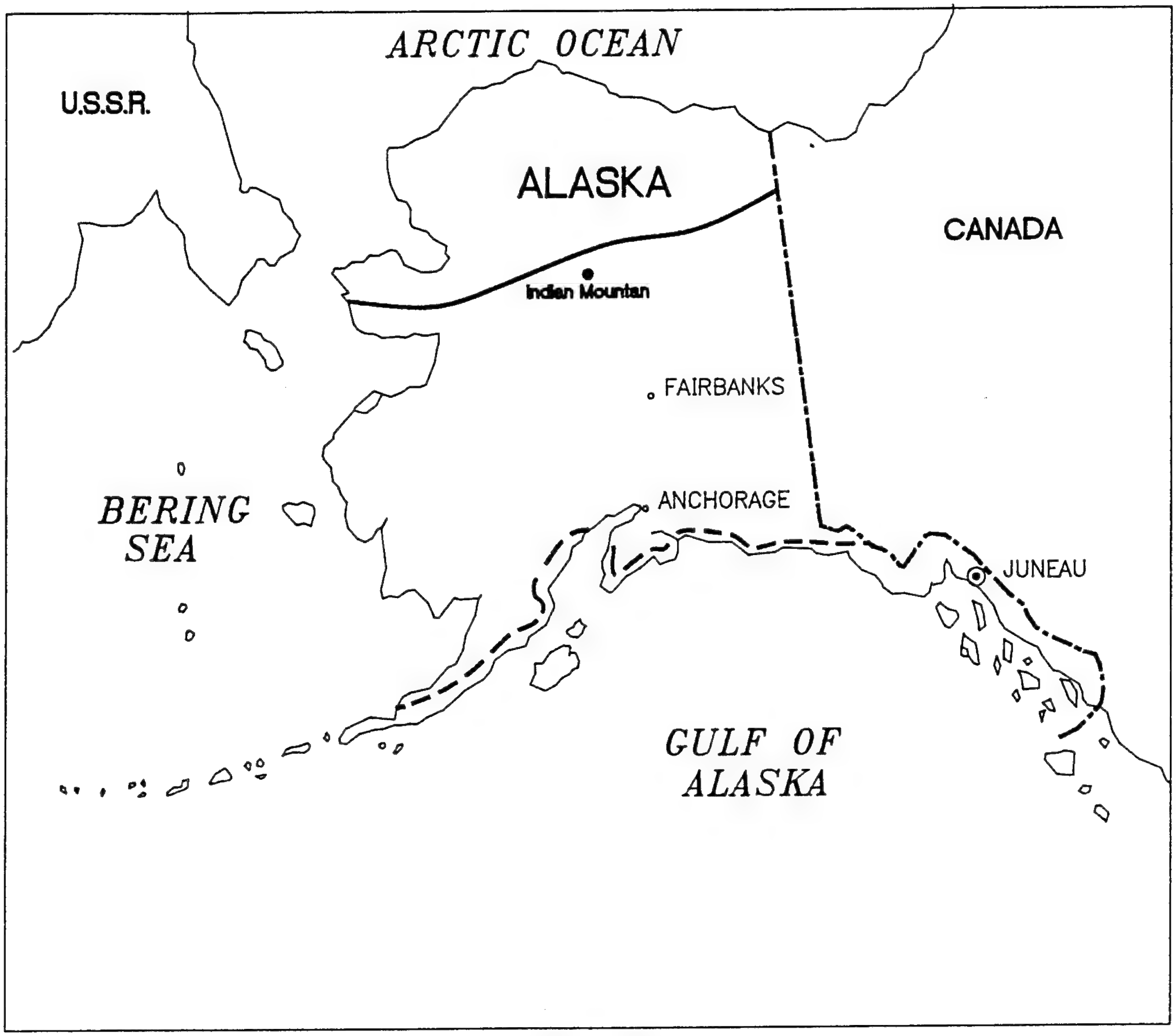
Permafrost is defined as perennially frozen ground. It is a condition of earth materials, such as soil, clay, silt, gravel, sand, or bedrock, that exists when the temperature of these materials remains below 32 degrees Fahrenheit (°F) for a minimum time period of two years (Williams 1970). Ice is an important component of permafrost, but is not necessary for the condition to exist. Earth materials that contain no ice but are in a condition of permafrost are referred to as "dry permafrost" (Levinson 1974). Permafrost is overlain by an active layer that is subject to annual freeze-thaw cycles. The active layer generally ranges between 1.5 feet to 3 feet in thickness where moss and vegetation insulate the earth materials. Where earth materials are exposed or disturbed, the active layer can be up to 15 feet thick. The permafrost table is defined as the zone at the base of the active zone where earth materials remain perennially frozen (Williams 1970).

Permafrost regions can be divided into two zones: discontinuous and continuous. Schematic profiles representative of these zones are shown on Figure 2.1-2. In the discontinuous zone there may be lenses, or layers, of permafrost separated by unfrozen ground. Figure 2.1-1 shows the distribution and extent of continuous and discontinuous permafrost zones in Alaska. The present southern boundary of the permafrost zone broadly parallels the 32° F annual isotherm in surface air (Flint 1971). It can be seen in Figure 2.1-1 that Indian Mountain is located near the northern limit of the zone of discontinuous permafrost.

Permafrost varies in thickness from a few inches or feet at the southern limit, to about 200 feet at the boundary of the discontinuous/continuous zones. In the northern part of the continuous zone, permafrost may reach thicknesses of over 2,000 feet (Levinson 1974).

Large bodies of water greatly influence the distribution and thermal regime of permafrost. An unfrozen zone exists beneath bodies of water that do not freeze solid during the winter months. The extent of the thawed zone beneath water bodies (called talik) will vary with a number of factors including the areal extent and depth of water, thickness of winter ice on the water body, snow cover, composition of the bottom sediment, and most importantly water temperature. As a generalization, 100 feet of thaw will be found in the underlying earth materials for each degree Fahrenheit the bottom water temperature exceeds 32° F (Levinson 1974).

Unfrozen groundwater above, within, and beneath permafrost is called, suprapermafrost, intrapermafrost, and subpermafrost groundwater, respectively (Cedarstrom et al. 1953). In North America, ground ice in permafrost regions is not considered to be groundwater (Meinzer 1923).



EXPLANATION

Approximate southern limit of continuous permafrost (solid line)

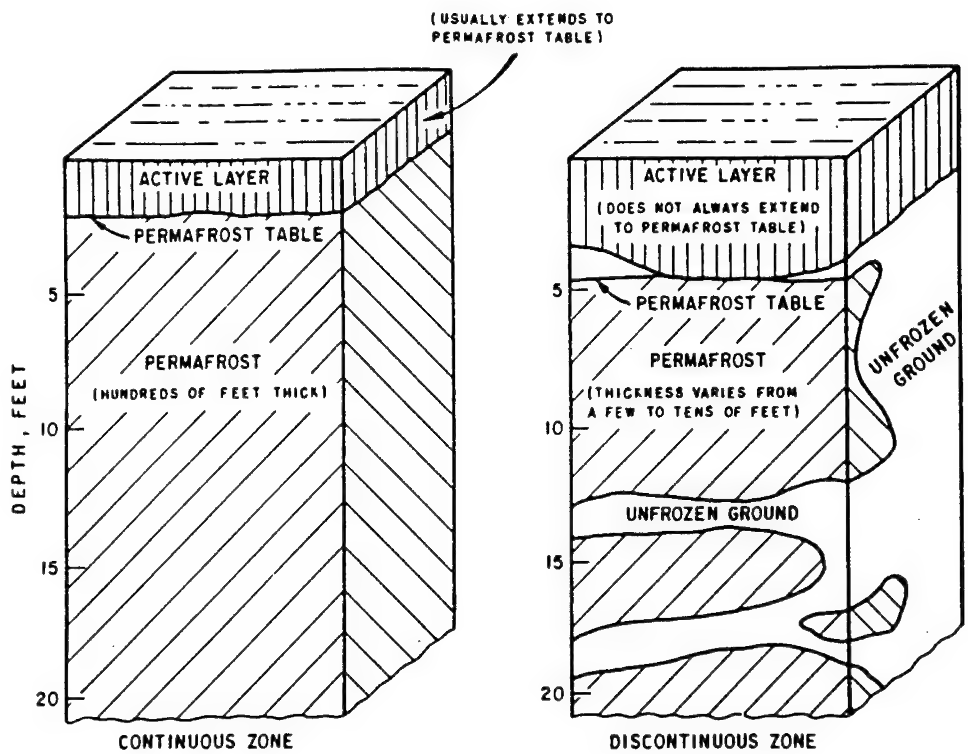
Approximate southern limit of discontinuous permafrost (dashed line)

INDIAN MOUNTAIN LONG RANGE RADAR STATION

Extent of Continuous and Discontinuous Permafrost Zones in Alaska (Modified from Williams, 1970)

PROJ. MGR.	ACAD FILE NO.	FIGURE NO.
L.SCHUETTER	FIG2_1-1	2.1-1
DRAWN BY: HUNTER	PROJ. NO.: 05-G-46200	DATE: 4/20/94

Permafrost



INDIAN MOUNTAIN
LONG RANGE RADAR STATION

Typical profiles of permafrost in the continuous and discontinuous zones (Brown, 1970)

PROJ. MGR.	ACAD FILE NO.	FIGURE NO.	
L.SCHUETTER	FIG2_1-2	2.1-2	
DRAWN BY	PROJ. NO.		DATE
HUNTER	05-G-46200		4/20/94

Ground ice can be grouped into five main types (Pewe 1975):

- Pore ice;
- Segregated, or Tabor ice;
- Foliated, or wedge ice;
- Pingo ice; and
- Buried ice.

Pore ice is defined as ice that fills or partially fills pore spaces in earth materials. It forms by freezing pore water in situ with no addition of water. The ground contains no more water in the solid state than it could hold in a liquid state.

Segregated, or Tabor ice is described as ice seams, lenses, or layers generally 1 to 100 millimeters thick that grow in the ground by drawing in water as the ground freezes. Segregated ice has been referred to by various terms including ice seams, ice segregations, ice gneiss, and sirloin-type ice (Pewe 1975). This type of permafrost ice is considered to be supersaturated because it contains more water in the solid state than the ground could hold if the water were in the liquid state. The mechanism by which water is drawn into the ground is not known (Pewe 1975).

Pore ice and segregated ice can both occur in both the seasonally frozen active layer and in the underlying permafrost.

Foliated ground ice or wedge ice is the term given to large masses of ice that grow in thermal contraction cracks in permafrost.

Pingo ice is clear or relatively clear ice that occurs in permafrost in nearly horizontal or lens-shaped masses 3 to 15 meters in diameter. It originates as groundwater under hydrostatic pressure that migrates to zones within the permafrost which are under lower confining pressure and then freezes.

Buried ice in permafrost includes buried sea, lake, and river ice and recrystallized snow. Blocks of glacier ice buried in a permafrost climate would also fall into this category. Buried ice is fossilized surface water.

Recharge of groundwater in a permafrost region is principally from infiltration of rainfall or snowmelt, or from bodies of surface water. As water percolates downward, it is blocked at the permafrost table. The permafrost table holds suprapermafrost (perched) water near the surface, and this accelerates evaporation and transpiration during the summer (Williams 1970). Permafrost results in poorly drained soils and the typical muskeg and marsh vegetation of tundra regions because surface water cannot infiltrate below the active zone.

Subpermafrost groundwater can only be recharged through unfrozen areas that penetrate the permafrost, such as those beneath streams and lakes. Suprapermafrost water migrates laterally on the slope of the permafrost table until it discharges at the surface or reaches an unfrozen zone. If the water table in the unfrozen zone is below the level of permafrost, then the suprapermafrost water will move downward until it reaches the water table.

As previously described, permafrost acts as an aquiclude or aquitard; therefore, water below the permafrost layer (subpermafrost groundwater) is confined (Fetter 1988). Wells completed in the subpermafrost aquifer may be flowing or nonflowing

artesian wells, depending on the head potential of the confined aquifer due to surface topography and the configuration of the permafrost layer. Subpermafrost groundwater may discharge into or be recharged from rivers and lakes beneath which taliks may provide conduits or through unfrozen areas in the zone of discontinuous permafrost.

2.1.2.2 Geology of Indian Mountain LRRS

The Indian Mountain LRRS is located in the southeast quadrant of the Hughes 1:250,000 quadrangle and in the northeast quadrant of the Melozitna 1:250,000 quadrangle. The geology of the Indian Mountain area is shown on Figure 2.1-3.

The oldest geologic unit mapped in the Indian Mountain area consists of volcanic rocks of andesitic composition (Patton and Miller 1966). This unit was deposited in a marine environment and consists primarily of tuffs, tuff-breccias, and agglomerates intercalated with flows. Locally, the unit may also include minor basalt flows, volcanic graywacke, mudstone, and/or fossiliferous limestone. The majority of the unit is believed to be from the Late Jurassic and Early Cretaceous periods. A potassium-argon age determination for volcanic rocks on Hughes Creek resulted in a date of 134 ±5 million years (Patton and Miller 1966). Both the Upper Camp and Lower Camp at the Indian Mountain LRRS are underlain by this unit (Figure 2.1-3). Descriptions of bedrock from the borings made at Lower Camp are generally sparse. These descriptions indicate that bedrock is composed of volcanic material, has been highly weathered, and is difficult to distinguish from the overlying alluvium.

The andesitic volcanic unit is unconformably overlain by an Early Cretaceous graywacke-mudstone unit. The graywacke is of variable composition and is poorly sorted, but generally contains an abundance of feldspar and volcanic rock detritus. Lenses of chert and igneous pebble conglomerates may be present. The mudstone is interbedded with the graywacke, and is dark gray to olive in color. Volcanic tuffs may be present locally. This unit is located to the north, east, and south of Indian Mountain (Figure 2.1-3).

The graywacke-mudstone unit may grade laterally to the south into tuffaceous volcanic graywacke and mudstone. The tuffaceous volcanic graywacke and mudstone unit contains a much higher content of volcanics and volcanically derived material than the graywacke-mudstone unit.

The volcanic and sedimentary units were subsequently intruded by a granodiorite/quartz monzonite pluton. This pluton, which covers an area of approximately 50 square miles, is dumbbell-shaped, and lies north and west of the Lower Camp (Figure 2.1-3). A portion of the northern lobe of this pluton is exposed at lower elevations on the west side of Indian Mountain. The pluton is generally medium-grained. Locally, the pluton is intruded by dikes of fine-grained aplite or alaskite. This pluton has been assigned a Late Cretaceous age based on potassium-argon determinations of 82 ±3 million years (Patton and Miller 1966).

A contact metamorphic aureole with a radius of up to one mile developed around the margin of this pluton (Figure 2.1-3). The graywacke-mudstone unit has been thermally metamorphosed to a resistant dark brown hornfels. The andesitic volcanics have been thermally metamorphosed to a narrow zone of hornblende hornfels adjacent to the contact, grading outward into a much broader zone of propylitic alteration which was mapped on the basis of incipiently recrystallized rock containing abundant chlorite, epidote, calcite and sodic plagioclase (Patton and

Miller 1966). The peak of Indian Mountain is within the broad zone of propylitic alteration.

Subsequent to emplacement of the pluton, hydrothermal mineralization occurred near the contact primarily within and adjacent to the pluton. Mineralization takes the form of both disseminations of pyrite and chalcopyrite, and as veins and veinlets of barite-tetrahedrite-sphalerite-galena. Chemical and mechanical weathering of these primary deposits has led to the development of secondary alluvial deposits of placer gold. The placer deposits of the region were actively mined from the late 1880s to about 1915. The placer deposits around Indian Mountain are still being worked, but only seasonally and on a small scale.

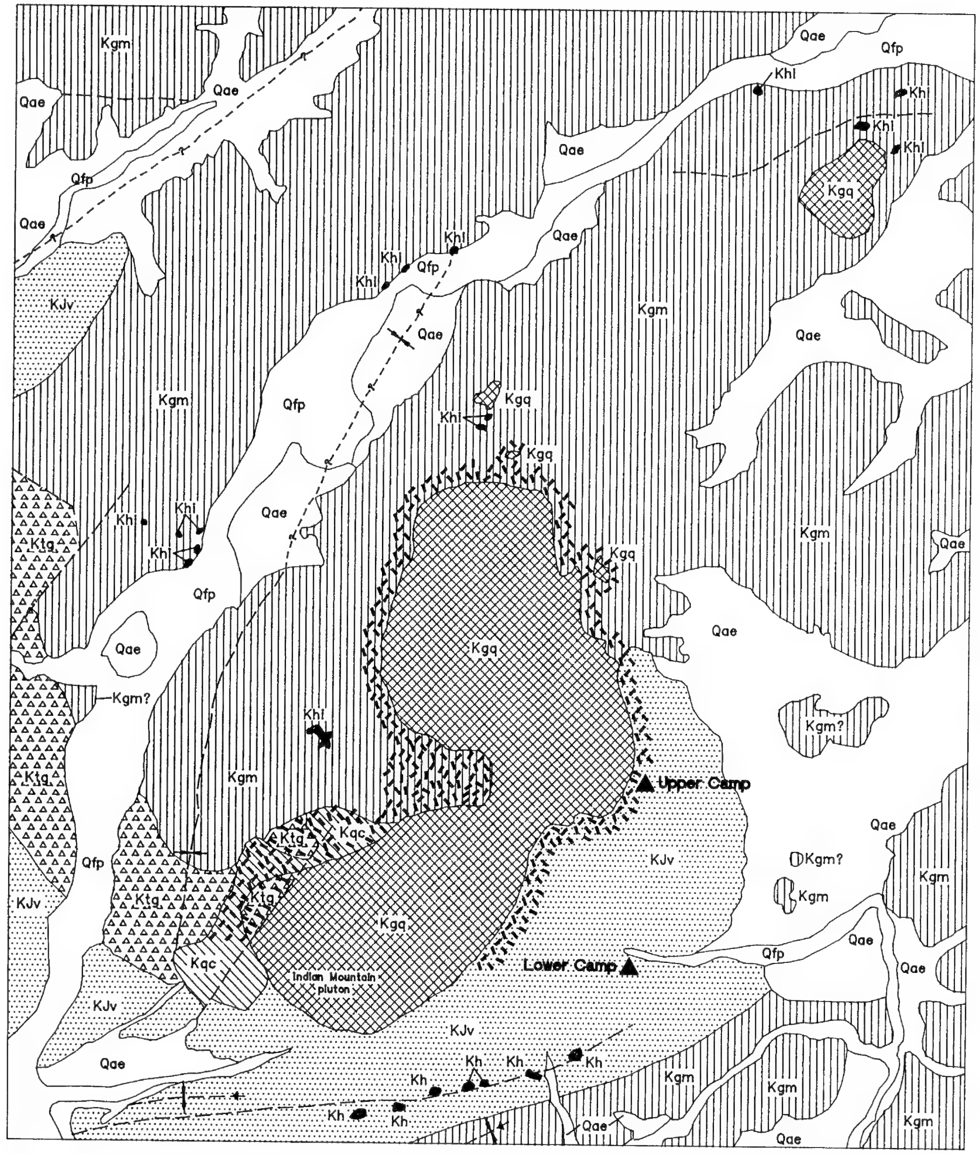
Mercury was commonly used by placer miners for recovery of flour gold (very fine size fraction) through the process of amalgamation, and in many placer mining areas throughout North America mercury was released to the streams as a contaminant introduced by placer mining activities. It would not be unexpected to find mercury attributable to mining recovery processes in both Indian River and Utopia Creek.

An east-west trending fault, approximately three miles long, is located to the south and west of Utopia Creek (Figure 2.1-3). There are numerous small bodies of hypabyssal intrusive rocks located along and within this fault. These hypabyssal rocks are chiefly fine-grained, light-colored dacite and rhyolite porphyry (Patton et al. 1978). These small intrusive bodies are thought to be contemporaneous with the larger granodiorite/quartz-monzonite plutons in the area; however, there are no age dates to confirm this (Patton et al. 1978).

During Illinoian time, piedmont ice sheets advanced out of the Brooks Range into the Koyukuk and Kanuti River lowlands north of Indian Mountain. The lower drainage of Mentanontli River was blocked by this ice sheet to an elevation of at least 1,000 feet (Reger 1979). An extensive proglacial lake was formed in the Mentanontli drainage, including the Notoniono Creek tributary system, as a consequence of this damming. Lacustrine clay was deposited in the proglacial lake. The total thickness of the clay is unknown, but is at least 61 centimeters (Reger 1979). This clay is present on the east side of Indian Mountain in the drainage basin of Notoniono Creek and its tributaries at elevations of less than 1,000 feet. Where present, this clay underlies the cover of surface vegetation.

Alpine glaciers were present at two distinct time periods on the northeast side of Indian Mountain in Cirque Creek and Sleepy Bear Creek drainages (Reger 1979). These drainages are shown on Figure 2.1-4. The older and more extensive of these glaciations is Illinoian in age. Terminal moraine material from this glacial period in the Sleepy Bear Creek drainage was deposited with an interfingering relation with lacustrine clay deposited in the proglacial lake in the Mentanontli drainage basin. Morphological evidence indicates a considerable amount of time elapsed between the earlier period of glaciation and the later period of glaciation. The later episode of glaciation covered a much reduced area. The latter episode is probably Wisconsin in age.

Erosion of the mineral deposits in and around the Indian Mountain Pluton has produced high concentrations of base metals in area streams (Miller and Ferrians 1968). Figure 2.1-5 shows the locations of stream sediment and rock samples collected in the vicinity of the Indian Mountain Pluton by the USGS for characterization of mineral deposits in the region (Miller and Ferrians 1968). In



Pleistocene and Recent

Qfp
Qae

Surficial deposits

Qfp, flood—plain deposits.
Qae, younger glacial drift, undifferentiated older glacial drift and alluvium, and undifferentiated alluvial and eolian terrace and slope deposits.

UNCONFORMITY

Lower and Upper (?) Cretaceous

Kqc

Quartzitic conglomerate and quartzite

Very light colored, thermally metamorphosed quartz conglomerate and quartzose sandstone along southwestern margin of Indian Mountain pluton. Probably late Early or early Late Cretaceous in age.

Ktg

Tuff, volcanic graywacke, and mudstone

Chiefly volcaniclastic rocks of andesitic and latitic composition. Age of unit uncertain; overlies andesitic volcanic rocks (KJv) and may grade northward into graywacke and mudstone unit (Kgm).

Kgm

Graywacke and mudstone

Dark greenish—gray to brown, fine—to coarse—grained, locally calcareous, poorly sorted graywacke interbedded with dark—gray to olive mudstone. Unit thermally metamorphosed to resistant dark—brown hornfels near Indian Mountain. Assigned a late Early Cretaceous (Albian) age on basis of occurrence of Grantziceras and Cleoniceras.

UNCONFORMITY

Upper Jurassic and Lower Cretaceous

KJv

Andesitic volcanic rocks

Chiefly andesitic crystal—bearing lithic tuff, tuff breccia, and agglomerate intercalated with porphyritic pyroxene andesite and trachyandesite flows. Some basalt flows. Unit thermally altered near granitic plutons; narrow zone of hornblende hornfels next to contact grades outward into broad band of incipiently recrystallized rock which contains abundant chlorite, epidote, calcite, and sodic plagioclase. Bulk of unit thought to be of Late Jurassic and Early Cretaceous age on basis of: (1) occurrence of Buchia sublaevis (Keyserling) and B. crassicolis (Keyserling) (table 1) of Early Cretaceous (Neocomian) age and (2) a potassium—argon age determination for volcanic rocks on Hughes Creek of 134±5 m.y. (latest Jurassic or earliest Cretaceous).

SYMBOLS

Zone of thermal metamorphism

Contact

Fault

Dashed where approximately located or inferred; dotted where concealed; queried where doubtful

Anticline

Showing position of crestline. Dashed where approximately located or inferred; dotted where concealed; queried where doubtful

Syncline

Showing position of crestline and direction of plunge. Dashed where approximately located of inferred; dotted where concealed; queried where doubtful

GRANITIC ROCKS

CRETACEOUS

Kgq

Granodiorite and quartz monzonite

Chiefly medium—grained hornblende—biotite granodiorite and quartz monzonite with lesser amounts of dark colored hybrid diorite. Assigned a Late Cretaceous age on basis of potassium—argon age determinations of 82±3 m.y. from the Indian Mountain and Zane hills plutons.

Khl

Hypabyssal intrusive rocks

Small bodies of chiefly latite and quartz latite porphyry. Occur in satellitic swarms around Indian Mountain and Mount George plutons.

INDIAN MOUNTAIN
LONG RANGE RADAR STATION

Geologic Map of Indian Mountain
(Patton and Miller, 1966)
(Patton and others, 1978)

PROJ. MGR.	ACAD FILE NO.	FIGURE NO.	
L.SCHUTTER	FIG2_2-1	2.1-3	
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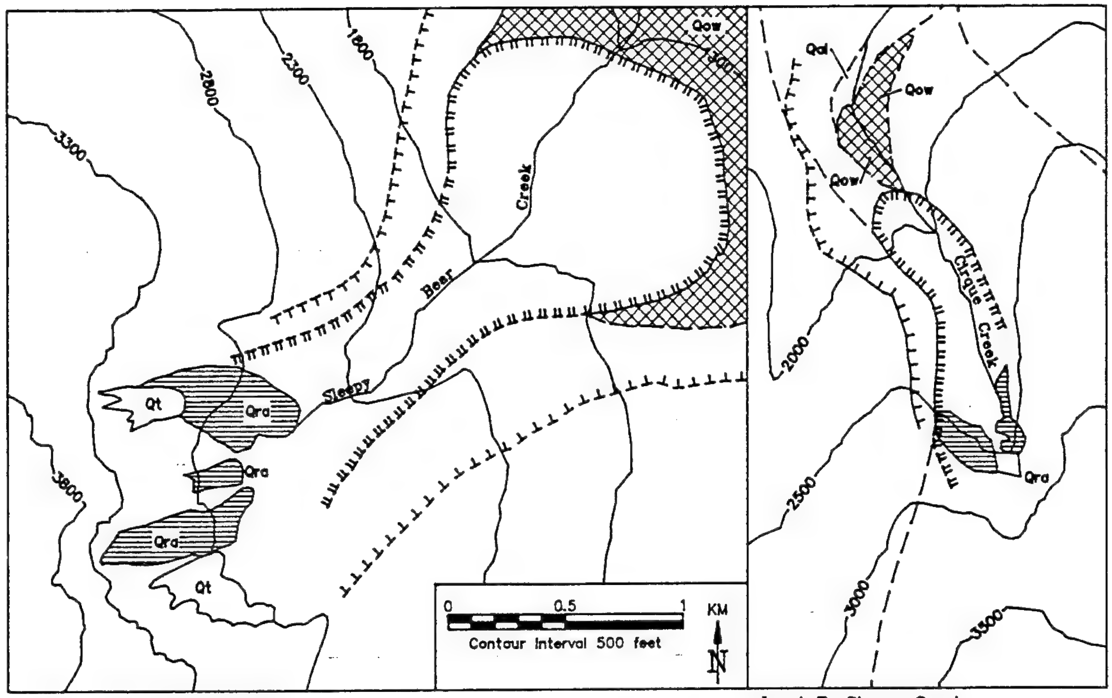


Inset A. Sleepy Bear Creek

Inset B. Cirque Creek

EXPLANATION

Pleistocene

post-Indian Mountain cold period

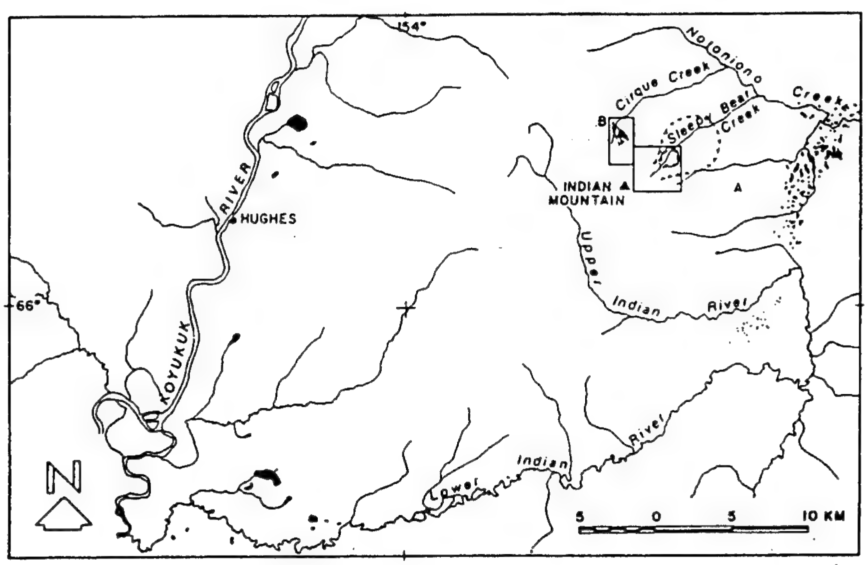
- Qal — Alluvium
- Qra — Rock glacier rubble
- Qt — Talus

Indian Mountain Glaciation

- ⊓⊓⊓ Drift limit (dashed where approximate)
- Qow — Outwash alluvium

Sleepy Bear Glaciation

- ⊥⊥⊥ Drift limit (dashed where approximate)



Locations of Insets

INDIAN MOUNTAIN LONG RANGE RADAR STATION

General location of Indian Mountain and alpine glaciation in the vicinity. Insets A and B above show details. (Modified from Reger, 1979)

PROJ. MGR.	ACAD FILE NO.	FIGURE NO.
L.SCHUETTER	FIG2_2-2	2.1-4
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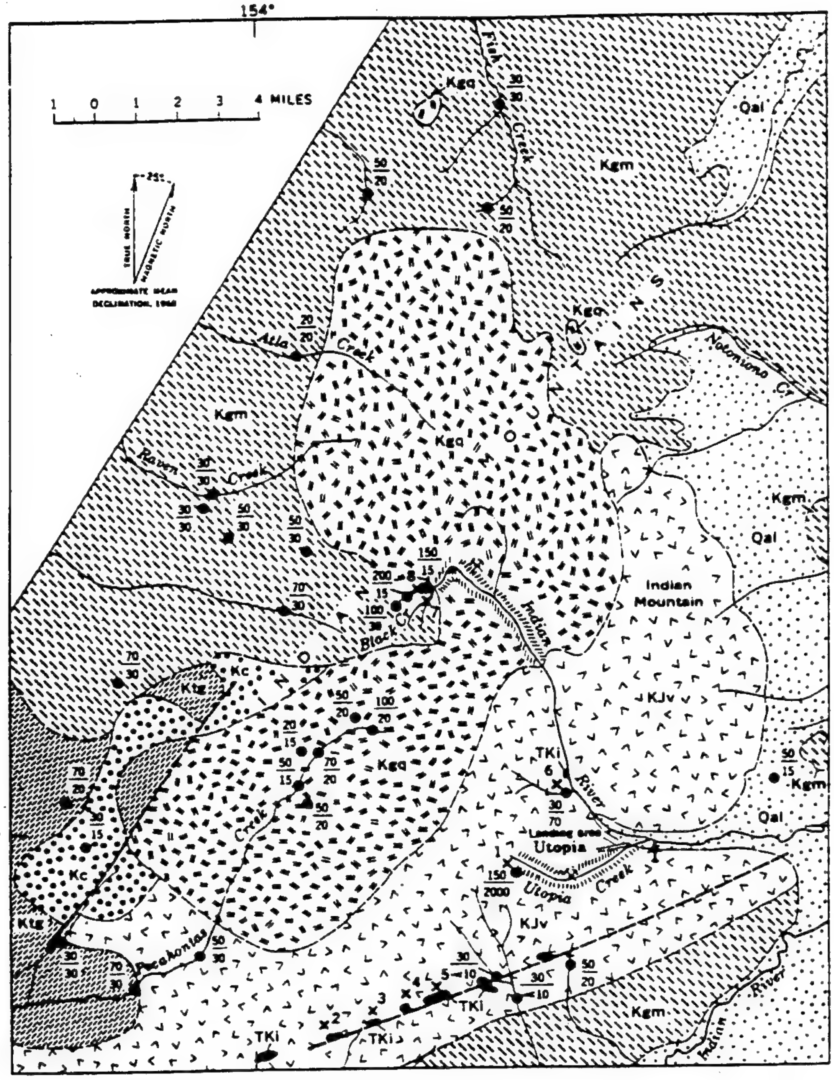


EXPLANATION

QUATERNARY
- Qal — Alluvium

CRETACEOUS OR TERTIARY
- TKi — Fine-grained felsic intrusive rocks

CRETACEOUS
- Ktg — Tuff, graywacke, and mudstone
- Kgq — Granodiorite and quartz monzonite
- Ktm — Graywacke and mudstone
- Kc — conglomerate

JURASSIC (?) AND CRETACEOUS
- KJv — Andesitic volcanic rock

Apprximate contact

Fault

30 / 70 Sample of stream sediment
Copper content above, lead below, in parts per million

x2 Location of analyzed rock samples discussed in table 2.1-1

Abandoned mine

Tailings

INDIAN MOUNTAIN LONG RANGE RADAR STATION

Locations of stream sediment samples and rock samples in the vicinity of Indian Mountain. Stream sediment values for copper and lead are indicated on the map (Miller and Ferrian, 1968)

PROJ. MGR.	ACAD FILE NO.	FIGURE NO.	
L.SCHUETTER	FIG2_2-3	2.1-5	
DRAWN BY	PROJ. NO.		DATE
HUNTER	05-G-46200		4/20/94

stream sediment samples, copper concentrations were as high as 200 parts per million (ppm) and lead concentrations as high as 2,000 ppm. Results of analyses conducted on rock samples indicate that molybdenum, zinc, silver and gold are locally present at elevated levels, in addition to copper and lead (Table 2.1-1). Other metals may be present at elevated concentrations due to hydrothermal mineralization but were not analyzed or reported. Depending on the presence of mineralization, soil, alluvium and/or colluvium beneath both Lower Camp and Upper Camp may have elevated concentrations of metals due to weathering and erosion of metalliferous deposits.

2.1.3 Groundwater

The primary aquifer at Indian Mountain LRRS is the alluvial deposits in the drainage of Indian River and its tributaries. The alluvium consists of stratified silt, sand, and gravel deposits. The alluvium is at least 25 feet thick adjacent to the Indian River near Lower Camp, where a water supply well for use at the station was installed to this depth (Air Force 1991). Subsurface conditions below 25 feet along Indian River have not been defined. Figure 2.1-6 is a schematic cross section through Lower Camp illustrating permafrost, groundwater, and bedrock as known from boring logs and test pits. Figure 2.1-6 shows that the alluvium ranges from 20 to 40 feet thick beneath most of Lower Camp and the area immediately uphill from Lower Camp. At the water supply well, groundwater is probably in connection with Indian River, and remains unfrozen all year round.

Borings beneath Lower Camp show that the aquifer in this area is contained within both alluvial silts, sands, and gravels and weathered or fractured bedrock.

Boring logs indicate there is a lens of permafrost beneath Lower Camp, which appears to strongly influence groundwater. The upper surface of this lens beneath Lower Camp is generally 12 to 16 feet beneath the surface. The presence of a saturated zone, or perched water, immediately above the permafrost table was noted on some of the boring logs (Air Force 1968). The presence of abundant water, with a depth ranging from 0 to 14 feet, is indicated on only one boring log. The level of water in the borehole appears to fluctuate depending on precipitation events, indicating that water in this boring may reflect surface water runoff rather than groundwater conditions. Suprapermafrost groundwater in the vicinity of Lower Camp probably migrates to either Indian River or Utopia Creek because the permafrost table generally reflects surface topography.

Most of the boreholes in Lower Camp penetrated the permafrost lens into unfrozen material at depths generally ranging from 40 to 50 feet beneath the surface. Groundwater was generally encountered within a few feet of the bottom of the permafrost lens. The groundwater is present under confined conditions. In many of the boring logs it is noted that groundwater levels stabilized at up to 14 feet above the water-bearing interval. This indicates that the permafrost lens is an effective confining layer. Geologic and groundwater information for all borings available is summarized on Table 2.1-2.

Groundwater conditions immediately west and upgradient of Lower Camp are not known because of permafrost conditions that are different than those present in Lower Camp. West of Lower Camp, the permafrost zone appears to be much thicker, generally extending from immediately beneath the vegetation to depths that

TABLE 2.1-1
Analyses of Selected Grab Samples from the Indian Mountain Area

Sample No.	Lab. No.	Cu	Ag	Au	Pb	Zn	Mo	Description
1A	ACN-801	7	3	0.16	1,000	N	7	Massive white barite with no visible metallic minerals.
1B	996	1,500	700	1.3	1,500	3,000	5	Massive white barite with minor amounts of tetrahedrite, galena, and sphalerite; Sb = 1,000 ppm.
1C	ACC-115	150	3	0.07	2,000	700	3	Stream sediment.
2	64M1705	50	7	0.04	300	N	7	Oxidized pyritiferous fine-grained intrusive.
3	ACN-999	100	3	0.1	100	N	N	Same as above.
4A	998	200	N	N	70	N	0.5	Same as above.
4B	997	300	N	N	70	N	N	Oxidized pyritiferous andesite.
5	996	30	N	N	30	N	7	Oxidized pyritiferous fine-grained intrusive.
6A	496	150	2	0.5	3,000	700	7	Oxidized pyritiferous andesite.
6B	ACC-251	1,000	15	0.2	1,000	700	20	Oxidized and silicified, fine-grained intrusive with disseminated pyrite and sphalerite.
6C	252	20	7	N	200	N	N	Deeply oxidized pyritiferous fine-grained intrusive.
6D	253	100	0.7	0.1	500	500	5	Oxidized pyritiferous andesite.
6E	254	700	1	6	1,000	500	30	Oxidized pyritiferous fine-grained intrusive.
6F	255	20	<0.5	N	20	200	N	Same as above.
Limits of determination		5	0.5	0.02	10	200	5	

Sample No.	Lab. No.	Cu	Pb	Ag	Au	Mo	B	Description
7A	ACN-492	30	15	N	N	7	15	Pyritiferous hornfels.
7B	493	20	<10	N	N	N	15	Pyritiferous fine-grained felsic intrusive.
7C	494	1,000	20	0.5	N	5	200	Pyritiferous hornfels.
7D	495	50	15	<0.5	N	N	20	Pyritiferous hornfels.
7E	862	700	15	N	N	N	1,500	Pyritiferous hornfels.
7F	863	700	15	N	N	15	70	Pyritiferous hornfels.
7G	864	500	30	N	0.04	N	N	Pyritiferous hornfels.
7H	865	700	10	N	N	N	N	Pyritiferous hornfels.
8	ACC-102	1,000	N	N	0.05	7	N	Pyritiferous hornfels.
Limits of determination		5	10	0.5	0.02	5	10	

Results reported in parts per million. Gold analysis by atomic absorption except for sample 2, which is by fire assay. All other analyses are semiquantitative spectrographic with results reported to the nearest number in the series 1.0, 0.7, 0.5, 0.3, 0.2, 0.15, 0.1, N, not detected; <, present but below limit of determination or below values shown. Sample localities are shown in Figure 2.1-5.

Source: Miller and Ferrians 1968.

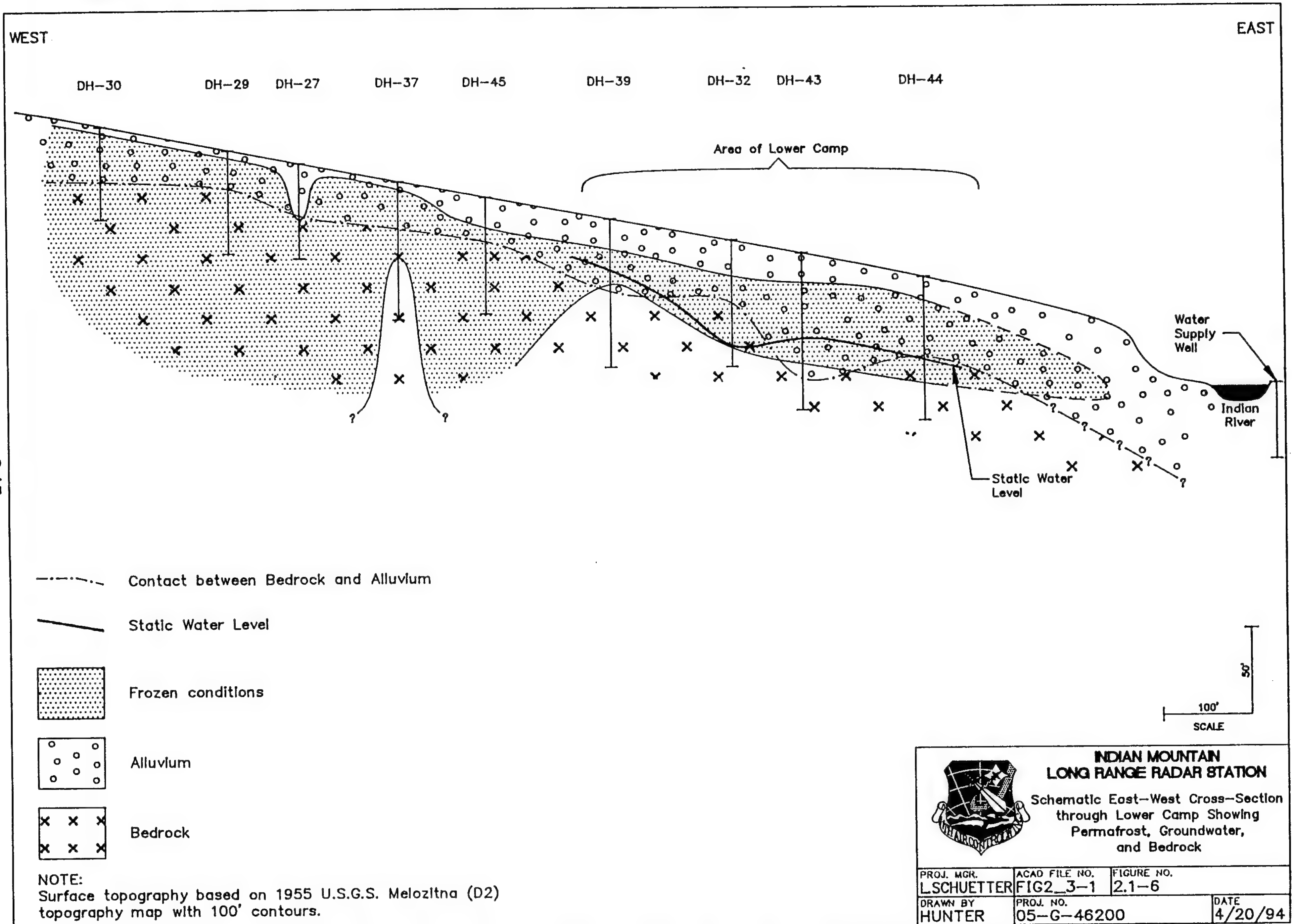

WEST
EAST
DH-30
DH-29
DH-27
DH-37
DH-45
DH-39
DH-32
DH-43
DH-44
Area of Lower Camp
Water Supply Well
Indian River
Static Water Level
Contact between Bedrock and Alluvium
Static Water Level
Frozen conditions
Alluvium
Bedrock
50'
100'
SCALE
NOTE:
Surface topography based on 1955 U.S.G.S. Melozitna (D2) topography map with 100' contours.
INDIAN MOUNTAIN
LONG RANGE RADAR STATION
Schematic East-West Cross-Section through Lower Camp Showing Permafrost, Groundwater, and Bedrock
PROJ. MGR. L.SCHUETTER
ACAD FILE NO. FIG2_3-1
FIGURE NO. 2.1-6
DRAWN BY HUNTER
PROJ. NO. 05-G-46200
DATE 4/20/94

TABLE 2.1-2
Boring Log Summary
Indian Mountain Long Range Radar Station, Alaska

Boring Number	Date Drilled	Coordinates (in feet) Northing	Coordinates (in feet) Easting	Depth to Groundwater (in feet)	Depth to Bedrock (in feet)	Predominant Alluvial Material	Bedrock	Interval of Frozen Conditions (in feet)	Total Depth of Borehole (in feet)
DDH-24	9/7/63	74,117	93,543	0-14; varies with precipitation	4	ND	felsite/dacite	ND	45.4
TP-24	Oct/56	–	–	Dry	>TD	sandy gravel	–	ND	8
TP-46	7/7/67	73,320	96,640	Dry	>TD	silt	–	4 - TD	22.5
TP-47	7/7/67	73,045	94,285	Dry	>TD	silty gravel	–	3.5 - TD	6
TP-48	7/8/67	73,140	94,600	Dry	>TD	silt and rock	–	0 - TD	10
TP-49	7/10/67	73,325	94,085	Dry	6	sandy-gravelly silt	dark, weathered	.5 - TD	13
TP-50	7/14/67	73,435	94,265	Dry	>TD	sandy silt	–	0-1.5, 6.5 - TD	10
TP-51	8/11/67	73,260	98,380	Dry	9	sandy, silty gravel	weathered	ND	9
TP-52	8/11/67	73,295	98,585	Dry	5.5	silty gravel	weathered	ND	7.5
TP-53	8/11/67	73,280	98,740	Dry	4	silty gravel	weathered	ND	6
DH-69	—	73,069	96,132	Dry	4	gravelly, silty sand	ND	ND	8
DH-68	—	73,028	95,973	Dry	3	gravelly, silty sand	ND	ND	12
DH-67	—	72,805	96,150	Dry	4.5	gravelly, silty sand	ND	0-1	12
DH-66	10/18/72	73,598	97,658	Dry	17	sandy silt with rock fragments	weathered	ND	22
DH-65	10/19/72	73,600	97,679	Dry	13	silt with rock fragments	weathered	ND	22
DH-64	10/18/72	73,564	97,516	Dry	12	silt with rock fragments	weathered	ND	22
DH-63	10/23/72	73,375	98,275	Dry	4	silty, sandy gravel	weathered	ND	7
DH-62	10/23/72	73,405	98,270	Dry	4	silty, sandy gravel	weathered	ND	7
DH-61	10/17/72	73,365	98,215	Dry	4	sandy silt	weathered	ND	7
DH-60	10/17/72	73,390	98,210	Dry	4.5	silt with rock fragments	weathered	ND	6

TABLE 2.1-2
Boring Log Summary (continued)
Indian Mountain Long Range Radar Station, Alaska

Boring Number	Date Drilled	Coordinates (in feet)		Depth to Groundwater (in feet)	Depth to Bedrock (in feet)	Predominant Alluvial Material	Bedrock	Interval at Frozen Conditions (in feet)	Total Depth of Borehole (in feet)
		Northing	Easting						
DH-57	10/21/72	73,457	97,860	Dry	>TD	silty, sandy gravel	–	ND	8
DH-56	10/18/72	73,635	97,832	Dry	>TD	rock and gravel fill	–	ND	1
DH-55	10/18/72	73,625	97,840	Dry	>TD	rock and gravel fill	–	ND	1
DH-54	10/18/72	73,632	97,841	Dry	>TD	rock and gravel fill	–	ND	1
DH-45	8/7/67	73,440	97,325	36	23	silt and gravel	ND	16-68	70
DH-44	8/7/67	73,515	97,795	32 aquifer at 45	33	silty gravel	meta-volcanic	16-45	60
DH-43	8/5/67	73,455	97,685	35 aquifer at 57	56	silty gravels	ND	13-41	70
DH-42	8/4/67	73,370	97,780	Dry	21	silty gravels	ND	no frost	65
DH-41	8/3/67	73,475	97,585	40 aquifer at 48	42	gravelly silt	meta-volcanic	17-42	70
DH-40	8/3/67	73,445	97,460	36 aquifer at 48	35	gravelly silt	meta-volcanic	4-48, 51-TD	70
DH-39	7/29/67	73,400	97,465	30 aquifer at 38	44	sandy, silty gravel	greenstone	12-37	70
DH-38	7/28/67	73,315	97,480	30 aquifer at 65	65	gravelly, silty sand	ND	18-65	70
DH-37	7/14/67	73,482	97,222	Dry	24	boulders and gravel	ND - difficult drilling	0->48	80
DH-36	7/13/67	73,340	97,606	57	17	silt, sand, and gravel	ND - difficult drilling	13-40	80
DH-35	7/12/67	73,280	97,298	41 aquifer at 47	44	gravels and silt	ND	0-24	53
DH-34	7/12/67	73,265	97,110	Dry	35	silt and gravel	ND	0-35	50
DH-33	7/11/67	73,200	97,780	Dry	19	silt	ND	1-TD	50
DH-32	7/10/67	73,428	97,600	46	19	silt, sand, gravel	ND	13-19, 24-46	50
DH-31	7/6/67	73,410	96,955	Dry	27	gravel and silt	ND	1-42	55
DH-30	7/5/67	73,525	96,925	Dry	33	silt and gravel	ND	5-TD	55
DH-29	7/4/67	73,425	97,035	Dry	23	silt and rock	ND	1-TD	55
DH-28	7/4/67	73,525	97,020	Dry	35	silt and gravel	ND	no frost	50
DH-27	7/3/67	73,470	97,128	Dry	30	gravel and silt	ND	31-TD	50

TABLE 2.1-2
Boring Log Summary (continued)
Indian Mountain Long Range Radar Station, Alaska

Boring Number	Date Drilled	Coordinates (in feet)		Depth to Groundwater (in feet)	Depth to Bedrock (in feet)	Predominant Alluvial Material	Bedrock	Interval at Frozen Conditions (in feet)	Total Depth of Borehole (in feet)
		Northing	Easting						
AP-70	3/16/81	73,230	97,334	Dry	>TD	gravelly, sandy clay	–	0-TD	13.5
AP-71	3/17/81	73,310	97,325	Dry	>TD	gravelly, silty sand	–	0-3, 4-TD	8
AP-72	3/17/81	73,261	97,255	Dry	>TD	gravelly, sandy clay	–	0-2, 13-TD	14
AP-73	3/17/81	73,327	97,172	Dry	>TD	sandy silts	–	0-2, 11-TD	13
AP-74	3/17/81	73,205	97,085	Dry	>TD	gravelly, sandy clay	–	0-4, 14-TD	14.5
AP-75	3/17/81	73,405	97,153	Dry	>TD	sandy, clayey, gravel	–	0-4, 5.5-TD	7
AP-76	3/17/81	73,375	97,225	Dry	>TD	gravelly, clayey sand	–	0-5, 11-TD	13
AP-77	3/18/81	73,298	97,331	Dry	>TD	sandy silt	–	0-TD	7.5
AP-78	3/18/81	73,323	97,161	Dry	>TD	silt and silty, sandy clay	–	0-2, 10-TD	12
AP-79	3/18/81	73,325	97,160	Dry	>TD	silty, sandy clay	–	0-2.5, 9-TD	10.5
AP-80	3/18/81	73,217	97,080	Dry	>TD	gravel	–	0-4, 13.5-TD	15.5
AP-81	3/18/81	73,380	97,220	Dry	>TD	sandy silt; gravelly, clayey sand	–	0-4.5, 8-TD	10.5

ND = data or information is not described
TD = total depth of borehole
>TD = greater than total depth of borehole

Borehole information is summarized from Air Force 1968, Air Force 1981

were generally greater than the boring depths (50 to 70 feet). Borings in this area were characterized as dry, or no mention was made of groundwater in the boring logs (Table 2.1-2). Although DH-37 is described as having penetrated permafrost at 37 feet, the boring log for this boring also indicates that drilling was very difficult, which may have obliterated evidence of frost conditions. The absence of subpermafrost groundwater at this location also indicates that permafrost may not have been penetrated.

At Upper Camp, the surficial material consists of thin, highly permeable residual colluvium, through which surface water rapidly infiltrates and groundwater percolates downslope, following bedrock contours, or the permafrost table (Air Force 1991).

2.1.4 Surface Water

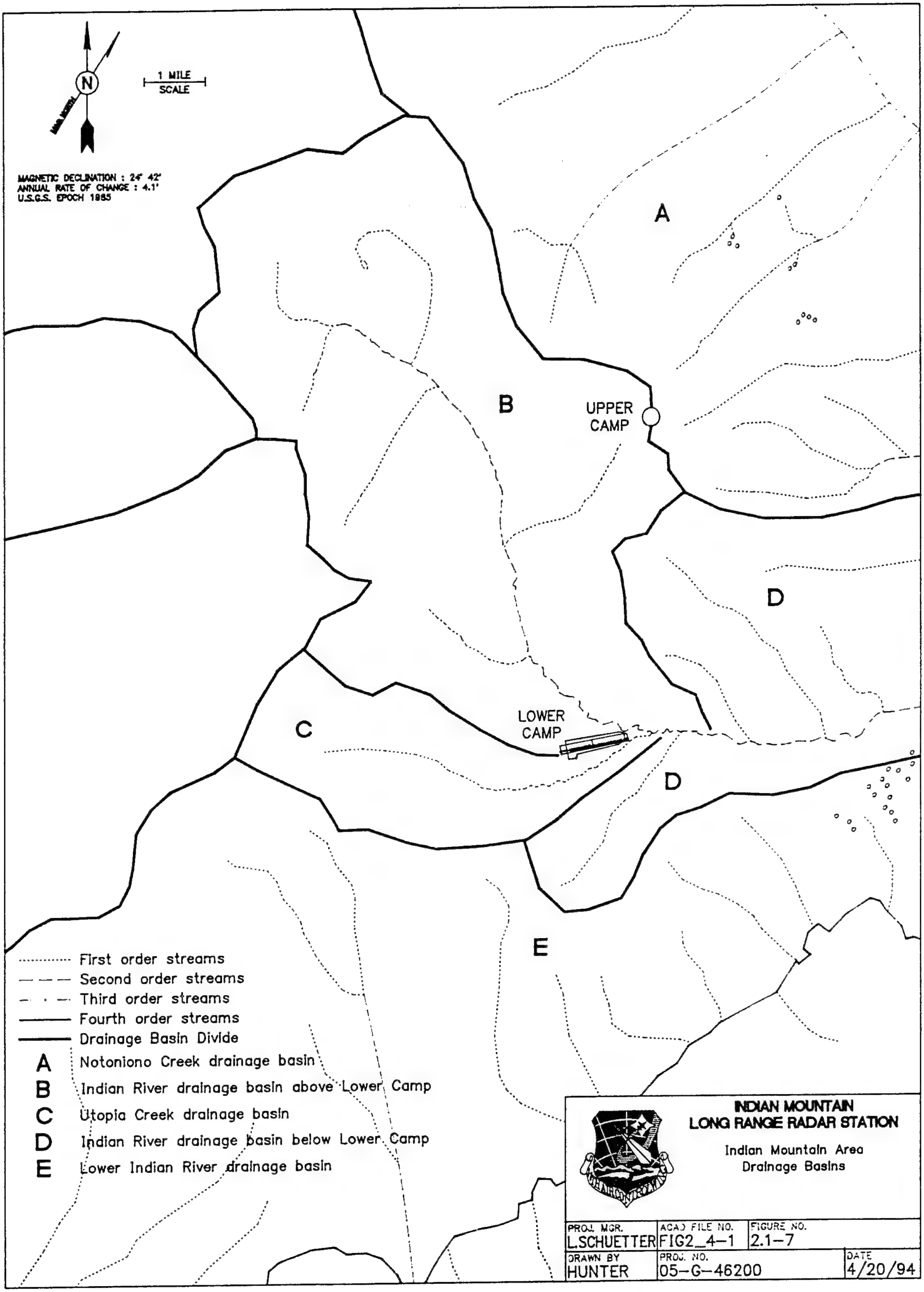
The Indian Mountain LRRS lies within the drainage basins of Indian River and Notoniono Creek. Upper Camp and portions of the road to Upper Camp are on the drainage divide between the Indian River and the Notoniono Creek drainage basins. Figure 2.1-7 shows drainage basins around the Indian Mountain LRRS and surface water tributaries within each drainage basin. Small, unnamed, first order streams drain Indian Mountain on its east and north sides. These streams join with Notoniono Creek at a distance of four to five miles from their headwaters. The majority of Upper Camp surface runoff flows to the northeast to Notoniono Creek. There are approximately 10 small lakes and ponds in low lying, low relief areas 2 to 3 miles northeast of Indian Mountain.

Lower Camp is situated at the confluence of Utopia Creek and Indian River at an elevation of just over 1,000 feet. The Indian River drainage basin above Lower Camp covers an area of approximately 39 square miles and displays a branching pattern of tributaries. Indian River above Lower Camp is a second order stream, and all of its tributaries above Lower Camp are unbranched, first order streams. The gradient of Indian River from Lower Camp to its headwaters averages 93 feet per mile. The first order tributaries to Indian River in this area are generally less than 2 miles long and have gradients ranging from 120 feet per mile up to 500 feet per mile. The average flow rate or seasonal variations in flow for Indian River are not known. Indian River appears to be a gaining river in the vicinity of Lower Camp relative to groundwater confined beneath permafrost (Figure 2.1-6).

Utopia Creek is an unbranched, first order tributary to Indian River. The drainage basin of Utopia Creek covers approximately 4 square miles, with an average gradient of 250 feet per mile. The average rate of flow or seasonal variations in flow rate for Utopia Creek are not known.

Approximately 3 miles of the headwater portion of Indian River and nearly the entire length of Utopia Creek have been extensively placer mined for gold. Placer operations severely disturb alluvial sediment. The modified alluvial deposits consist largely of very coarse, washed material with very little of the fine fraction of the sediment remaining. This material is very permeable, and is often sterile in part because of its inability to hold moisture.

Copper, lead, zinc, molybdenum, and silver occur at elevated concentrations in stream sediment and bedrock deposits in the Indian Mountain and Utopia Creek drainage basins (Miller and Ferrians 1968). It would not be unusual for elevated concentrations of other metals to be present in this geologic environment as well.



N
MAG NORTH
1 MILE
SCALE
MAGNETIC DECLINATION : 24° 42'
ANNUAL RATE OF CHANGE : 4.1'
U.S.G.S. EPOCH 1985
A
B
UPPER CAMP
D
LOWER CAMP
C
D
E
First order streams
Second order streams
Third order streams
Fourth order streams
Drainage Basin Divide
A Notoniono Creek drainage basin
B Indian River drainage basin above Lower Camp
C Utopia Creek drainage basin
D Indian River drainage basin below Lower Camp
E Lower Indian River drainage basin
INDIAN MOUNTAIN
LONG RANGE RADAR STATION
Indian Mountain Area
Drainage Basins
PROJ. MGR.
L.SCHUETTER
ACAD FILE NO.
FIG2_4-1
FIGURE NO.
2.1-7
DRAWN BY
HUNTER
PROJ. NO.
05-G-46200
DATE
4/20/94

Boulders of barite containing visible but minor amounts of tetrahedrite, sphalerite, and galena are also present in the headwater area of Utopia Creek.

2.1.5 Climatology/Meteorology

Indian Mountain LRRS is within the continental climatic zone. Summers in this zone are short and rainy, and winters are cold. Table 2.1-3 presents precipitation, snowfall, temperature, and wind data for the site. Approximately half of the annual precipitation falls as rain in summer, with August being the rainiest month. Winter snowfall averages near 9 feet annually. Temperatures are extreme, although not as extreme as in many other interior Alaska areas. The maximum recorded temperature was 89° F in July, and the minimum was -65° F, in January. Winds are light to moderate in the area and are predominantly from the east and northeast (Air Force 1991).

Indian Mountain is located 35 miles south of the Arctic Circle. Daylight is nearly continuous in June and July. In the winter, darkness prevails with only one to two hours of daylight in December and January (Air Force 1991).

2.1.6 Biological Resources

The U.S. Bureau of Land Management (BLM) Kobuk District's Central Resource Plan and Record of Decision designated 162,822 acres of land within the Indian River watershed as an Area of Critical Environmental Concern (ACEC). The Indian Mountain LRRS lies within this designated ACEC. The primary purpose of this special designation is to identify sensitive and valuable aquatic resources that require special management. The ACEC contains important chum salmon and chinook salmon production habitats that could potentially be impacted by land-use actions, particularly placer mining and associated activities (e.g., access, fuel storage, etc.). The draft Aquatic Habitat Management Plan (HMP) prepared by BLM describes actions to establish baseline data, sets objectives, and establishes management guidelines for the maintenance and protection of salmon production habitat (Morkill 1994).

BLM Kobuk District's goal for the Indian River ACEC is to ensure that the aquatic ecosystem can sustain an annual production potential of 3.1 million chum salmon eggs and 117,000 chinook salmon eggs over a 10-year period. The chum and chinook salmon that return annually to spawn in the streams within the Indian River are an important food source for local wildlife populations and people. Salmon produced in the Indian River watershed contribute to sport, commercial, and subsistence fisheries within the lower Yukon River Basin (Morkill 1994).

Providing for a sustained production of salmon requires that habitats used for spawning and rearing are protected and maintained in good to excellent condition. Condition and trend of salmon production habitat will be used by BLM as an indicator of the overall health and condition of the aquatic ecosystem within the ACEC (Morkill 1994).

The Indian Mountain LRRS is located in the east-central portion of the Hughes subdistrict of the BLM Kobuk District's Central Yukon Planning Area approximately 15 miles east of the village of Hughes. The ACEC consists of the upper Indian River watershed, which originates in the Indian River Uplands and flows in a rough semi-circle from its headwaters to the east, then south where it is joined by the westward-

TABLE 2.1-3
Indian Mountain Long Range Radar Station Climatological Data

Month	Temperature (°F)					Precipitation (in.)			Snowfall (in.)		Surface Winds	
	Mean			Extreme		Monthly		Max	Monthly			
	Max	Min	Monthly	Max	Min	Mean	Max	24 hrs	Mean	Max	Prevailing Direction	Speed (kt)
January	0	-13	-7	40	-65	1.2	4.8	1.3	15.4	64.0	ENE	5.5
February	4	-11	-3	38	-52	0.7	3.7	0.7	10.3	45.0	ENE	5.6
March	15	-1	7	39	-44	1.0	4.4	1.0	15.0	43.0	ENE	5.3
April	30	13	22	54	-24	1.1	3.5	1.0	14.0	36.0	ENE	5.8
May	52	34	43	78	-1	0.4	1.5		1.0	29.0	NE	6.1
June	66	45	56	88	30	1.6	3.8		0.1	0.0	NW	5.5
July	67	49	58	89	31	2.6	5.1	2.1	0.0	0.0	W	4.8
August	61	44	53	83	23	3.2	8.2	1.9	0.0	0.0	SW	4.4
September	48	33	41	73	3	2.3	4.8	3.3	3.0	0.7	NE	5.3
October	26	15	20	55	-25	1.6	2.0	1.2	15.5	18.0	ENE	5.8
November	12	-1	6	38	-38	1.7	2.0	1.5	22.7	31.0	ENE	5.4
December	3	-9	-3	36	-48	1.3	3.1	1.0	16.9	29.0	ENE	5.0
ANNUAL	32	17	24			18.7					ENE	5.4

Period of Record: 1949-1984
Source: Air Force 1991

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draining Calamity Creek and the northward-draining Big Creek, and then to the west.

2.1.6.1 Flora and Fauna of Indian Mountain LRRS

Flora. This subsection summarizes the prevalent floral species that are present on and around the Indian Mountain LRRS. Information pertaining to the vegetation in the vicinity of Indian Mountain is based on discussions with BLM personnel (Morkill 1994).

Elevations range from 500 feet along the Indian River to the 4,200-foot Indian Mountain. In the vicinity of Indian Mountain, well-drained, hilly, or southerly exposed sites are forested with a mixture of white spruce and deciduous species such as paper birch. Lowlands, poorly drained sites, and gentle slopes are dominated by open black spruce forest. On the depositing slopes of smaller meandering streams, the forest is largely white spruce, quaking aspen, willows, and balsam poplar. Treeline is at approximately 1,000 feet elevation on north-facing slopes and at 1,500 feet elevation on south-facing slopes. The transition zone between upland spruce forest and alpine tundra is predominantly tall shrub thickets, comprised of birch, alder, and willow. Alpine tundra is present generally above 2,000 feet elevation.

Fauna. This subsection summarizes the prevalent faunal species that occur on and around the Indian Mountain LRRS. Information presented includes mammals (terrestrial and aquatic) and birds (residential and migratory).

The Indian Mountain LRRS falls within the general range of many species of wildlife. Some of the more common mammals include moose, caribou, brown bear, black bear, wolf, beaver, and marten. Field observations during 1993 by BLM staff and onsite Air Force installation contractors, reported extensive beaver activity in Flat Creek and Big Creek. Other observations included several black bear sightings and a group of 20 caribou on Indian Mountain. Caribou from the Western Arctic Caribou Herd may occasionally winter in the general area of Indian Mountain (Morkill 1994). The Indian River area is also a brown bear denning habitat.

In addition, beaver, muskrat, and river otter use the various waterways and wetlands in the vicinity of Indian Mountain. Some of the smaller mammals that inhabit the region are shrew, marten, weasel, mink, pine squirrel, porcupine, and snowshoe hare (W-C, 1993).

Spruce grouse, ruffed grouse, sharp-tailed grouse, and rock ptarmigan also inhabit the area. Many passerine birds and a few raptor species live within the area of Indian Mountain, including raven, gray jay, common redpoll, white-crowned sparrow, red-tailed hawk, rough-legged hawk, bald eagle, and osprey.

Shrub thickets, particularly associated with water and riparian habitat, provide diverse vegetative structure and high productivity that has been highly correlated with breeding bird abundance, density, and species diversity. Crucial or critical habitats have not been identified for terrestrial species in the vicinity of Indian Mountain.

Some of the more common waterfowl that nest or migrate through the Indian Mountain area include American widgeon, mallards, green-winged teal, northern pintail, and Canada geese, white-fronted geese, and snow geese. The Indian

Mountain area also provides habitat for a variety of shorebirds such as spotted sandpiper, solitary sandpiper, and semipalmated plover (W-C, 1993).

Fishery Resources. Preliminary information regarding the chemical and physical characteristics of the Indian River and its tributaries was collected in 1993 by BLM. Final data analyses are not currently available. Based on surveys completed by BLM in July 1993, the most prevalent fish species observed using the Indian River in the vicinity of Indian Mountain included Arctic grayling, chinook salmon, and slimy sculpin. Other species identified in the Indian River include Dolly Vardon, northern pike, longnose sucker, whitefish, and chum salmon (Morkill 1994).

The residents of the village of Hughes have historically relied heavily on subsistence resources for food. Fish comprise the largest volume of the subsistence harvest in Hughes, and summer-run chum salmon make up the major portion of this. Much of the fishing takes place downstream from the mouth of the Indian River, and a significant portion of the fish may be destined for spawning grounds within the Indian River drainage.

2.1.6.2 Threatened and Endangered Species

No threatened or endangered plant species are known to occur on Indian Mountain. However, the yukon aster (*Aster yukonensis*), a candidate for threatened or endangered species listing, has been found on Kanuti National Wildlife Refuge (U.S. Fish and Wildlife Service [FWS] 1987). It is currently unknown whether the type or quality of habitat found at Indian Mountain is adequate to support yukon aster.

The only endangered fish or wildlife species known to exist in the vicinity of Indian Mountain is the American peregrine falcon. According to the FWS, no nests of American or Arctic peregrine falcon are known to occur within a 10-mile radius of Indian Mountain (Ambrose 1994). All cliffs below 2,500 feet elevation and nearby water should be considered potential nest sites for peregrine falcon. Peregrine falcon are known to migrate through the area in the vicinity of Indian Mountain.

2.1.7 Cultural/Archaeological Resources

The following cultural and archaeological resource discussion has been extracted from the Final Comprehensive Conservation Plan prepared for the Kanuti National Wildlife Refuge by the FWS (FWS 1987).

2.1.7.1 Cultural Resources

Kanuti Refuge lies within the historic territory of the Todadontan-Kanuti and South Fork bands of the Koyukuk River division of the Koyukon Athapaskans, the northwesternmost Indians in Alaska. Like other northern Athapaskans, the Koyukon could be characterized as seminomadic hunters with little or no political organization above the local band. The population on the Koyukuk River in the early nineteenth century ranged from 200 to 300 people.

The most important subsistence resources for the Koyukuk River people were caribou and, in varying numbers over time, moose. The Koyukuk groups had less access to salmon than did Koyukon living along the Yukon River, but they were the only Koyukon with direct access to the Brooks Range for Dall sheep. A variety of other fish, mammals, birds, and, to a lesser extent, plants were used depending on their seasonal availability.

Summer dwellings of the Koyukon were either skin tents or moss houses; winter dwellings were more substantial semisubterranean houses, most often accommodating two families. Other structures that may be reflected in the archaeological record include long "drift" fences, used in caribou hunting, and fish traps in some streams and lakes.

Before direct contact with Europeans, the Koyukon were already a strong link in the Alaska-Siberia fur trade, which may have brought European trade goods into Alaska even before Bering's discovery in 1741. Residents of the Koyukuk River area traded for obsidian from the Batza Tena source on the Little Indian River south of Indian Mountain, probably for as long as the area has been occupied.

The first direct contact between Koyukon and European in Koyukon territory probably occurred in 1837. The first trading post in Koyukon territory was established at Nulato on the Yukon River by Petr Vasil'evich Malakhov. He built his first cabin there in 1839, and the post became permanent when the cabin was rebuilt in 1841. The first white man to enter the immediate vicinity of the refuge was probably Alfred Mayo, who came overland from the Yukon River in 1884 to establish a trading post on the Kanuti River. In 1885, Lieutenant Henry T. Allen made the first nonnative reconnaissance of the Koyukuk River and surrounding area.

Steamboats first ascended the Koyukuk River in 1897, bringing the first influx of gold rushers to the area. By the time of F.C. Schrader's visit to the area in 1899, active mining camps existed along the Koyukuk River at Peavey, Union City, Soo City, and Seaforth. At the peak of activity, as many as 1,500 miners, prospectors, and others lived on the Koyukuk. By the turn of the century, activity had begun to decline; only about 100 nonnatives wintered there in 1899-1900. Sporadic mining in the area continued until about 1906.

Also in 1906, the St. John's-in-the-Wilderness Episcopal Mission was established at Allakaket. This establishment marked the beginning of a pattern that continues today. Schools and medical facilities have led to the establishment of more or less permanent villages and an increasingly sedentary lifestyle.

2.1.7.2 Archaeological Resources

This part of Alaska is archaeologically complex; it lies near the presumed boundary of pre-Eskimo and pre-Athapaskan populations. However, in the area of Indian Mountain, mostly sites of the "Indian" or interior sequence, as described below, are expected. No archaeological resources have been identified at the Indian Mountain LRRS.

The earliest occupations in the interior of Alaska that may be dated with relative certainty are about 12,000 years old. Some sites from the Porcupine River drainage in Canada suggest that humans may have been in the area as long ago as 25,000 years before Christ (BC). These earliest sites are of the following two general types:

- The first sites contained fluted projectile points similar to those found in the conterminous United States and Canada.
- The second sites do not contain such projectile points but do contain microblades that are much more closely related to materials from northeastern Asia.

One possibility is that paleo-Indian people moving to Alaska from the Great Plains were coming into contact with more recent Siberian immigrants. The next step in the sequence, the Denali complex, includes microblades made from wedge-shaped cores and certain other items such as a particular type of bone-working tool called a Donnelly burin. The Denali complex does not contain any of the types of projectile points that elsewhere descended from the paleo-Indian period. The beginning of the Denali complex dates to as early as 10,000 years ago.

Some investigators consider the Denali complex to continue until the beginning of the Christian era. However, it is possible to see a distinct change about 6,000 years ago with the appearance of large side-notched projectile points and a shift from wedge-shaped to tubular cores for the production of microblades. This new stage may be referred to as the Tuktu complex, first identified at Anaktuvuk Pass in the Brooks Range. The Tuktu complex is in turn part of the larger Northern Archaic tradition, which continues until about the year 1 anno Domini (AD).

Most sites dating from the beginning of the Christian era no longer have any microblades. The Athapaskan tradition can be considered to have begun at this time, although the first positively Athapaskan sites do not appear until about 1,000 AD. The whole period until European contact is characterized by small, tapered-stem projectile points and a number of far less distinctive features. It continues with little change until the increasing presence of trade goods makes it difficult to tell the camp of a Native trapper from that of his white counterpart.

2.2 SOURCE DESCRIPTIONS AND SITE-SPECIFIC ENVIRONMENTAL SETTING

A literature review was conducted using documentation from previous surveys and field investigations to compile information pertaining to contaminant sources previously identified at Indian Mountain LRRS. The following documents were reviewed to compile the site-specific environmental setting and past activities for each source:

- *Phase I - Records Search, AAC - Northern Region*, prepared by Engineering Science Inc. (ES), September 1985
- *Installation Restoration Program, Stage I, Phase II, Site Inspections Report for Fort Yukon, Murphy Dome, and Indian Mountain Air Force Stations, Alaska*, prepared by W-C, November 1990
- *Installation Restoration Program (IRP), Remedial Investigation/Preliminary Feasibility Study, Stage 2, Indian Mountain AFS, Alaska*, prepared by W-C, April 1991
- *Final Site Investigation Report, Indian Mountain LRRS, Alaska*, prepared by W-C, July 1993.

Additional sources of information included field notes pertaining to geotechnical investigations and demolition activities conducted at Indian Mountain LRRS. The following paragraphs provide source descriptions and history and a summary of previous investigations and findings. Information pertaining to the geology, hydrology, hydrogeology, biological and cultural resources, and demography is presented in Section 2.1. Information pertaining to the environmental setting at each source will be gathered during the 1994 field investigation.

Several of the units comprising the sources, such as waste accumulation areas, landfills, and spills or leaks, were grouped to be addressed as a source in the 1985 Records Search. The grouping criteria included geographic proximity and type of wastes. Figure 2.2-1 shows the sources located in Lower Camp, and Figure 2.2-2 shows the sources located in Upper Camp. Where information is available, units comprising the sources are shown on Figures 2.2-1 and 2.2-2. Specific locations for many of the spills and leaks are currently unknown and not shown on Figures 2.2-1 and 2.2-2. An attempt to locate the spills and leaks will be made during the site reconnaissance. All units comprising each source are described in the following subsections. Each source is identified by its current Air Force designation. In addition, previous designations are noted parenthetically to facilitate the use of historical information from previous studies.

2.2.1 SD01 (Source 9: Dump Areas)

A formal landfill was never established at the Upper Camp. Many of the wastes generated at the Upper Camp and WACS site were disposed of on the eastern and western slopes of the mountain. Wastes included rubbish, wood, metal, drums, plastic, and other debris. Some of the drums were partially filled with oil, ethylene glycol, or other waste POLs. In the period 1978 through 1980, a general cleanup of the Upper Camp was conducted. Wastes were moved to three dump areas on the mountain. According to the Phase I report (Air Force 1985), up to 10,000 drums were drained of remaining liquids, crushed, and buried. Collected liquids were shipped offsite. The Phase I report (Air Force 1985) concluded that the three dump areas required investigation and suggested that field activities for SD01 and SS10 (Sources 9 and 3) be combined. Field investigations have not been performed at SD01.

2.2.2 SS02 (Source 5: Waste Accumulation Area No. 1)

SS02 (waste accumulation area no. 1) is located just north of the runway at its eastern end at Lower Camp. The area was active from the 1950s to the mid-1980s. The area was used to store drums of waste before they were shipped offsite for disposal. In 1992 the area was flat and measured approximately 100 feet by 200 feet (Air Force 1993b). Soil from heavily contaminated areas was reportedly removed and shipped off-site for disposal in 1984.

The surface of the area was described, during the SI conducted by W-C in 1992, as mostly gravel with some clumps of vegetation (Air Force 1993b). Stained areas were not observed. W-C collected two subsurface soil samples at depths of 2.0 feet and 2.5 feet. These samples were co-located with surface samples collected 0.5 foot beneath the surface. The samples were analyzed for PCBs, pesticides, VOCs, SVOCs, and target analyte list (TAL) metals. The pesticides 4,4'-dichlorodiphenyldichloroethene (DDE), 4,4'-dichlorodiphenyldichloroethane (DDD), and 4,4'-dichlorodiphenyltrichloroethane (DDT) were detected in one subsurface and one surface soil sample at very low, estimated values. Tetrachloroethene was present in one subsurface and one surface sample at very low, estimated values. SVOCs were not detected in any of the samples. TAL metals were all below action levels, with the exception of arsenic.

2.2.3 SS03 (Source 7: Waste Accumulation Area No. 5)

SS03 (waste accumulation area no. 5) is located on the north side of the road to Upper Camp, approximately 400 feet north of Indian River. The area was used as a

waste storage area during the 1960s and 1970s. Spills and leaks occurred at the site and all oil drums were removed in 1980, according to the Phase I report (Air Force 1985). The area is topographically upslope of and on the same side of Indian River as the water supply well. Since it is believed that the river forms a hydraulic boundary that prevents groundwater migration across the river, SS03 should be the only source area with potential to affect groundwater quality at the water supply well. The Phase I report concluded that further investigation was required for SS03, although none of the field investigations performed at Indian Mountain have reported activities at the site.

2.2.4 LF04 (Source 4: Landfill No. 1)

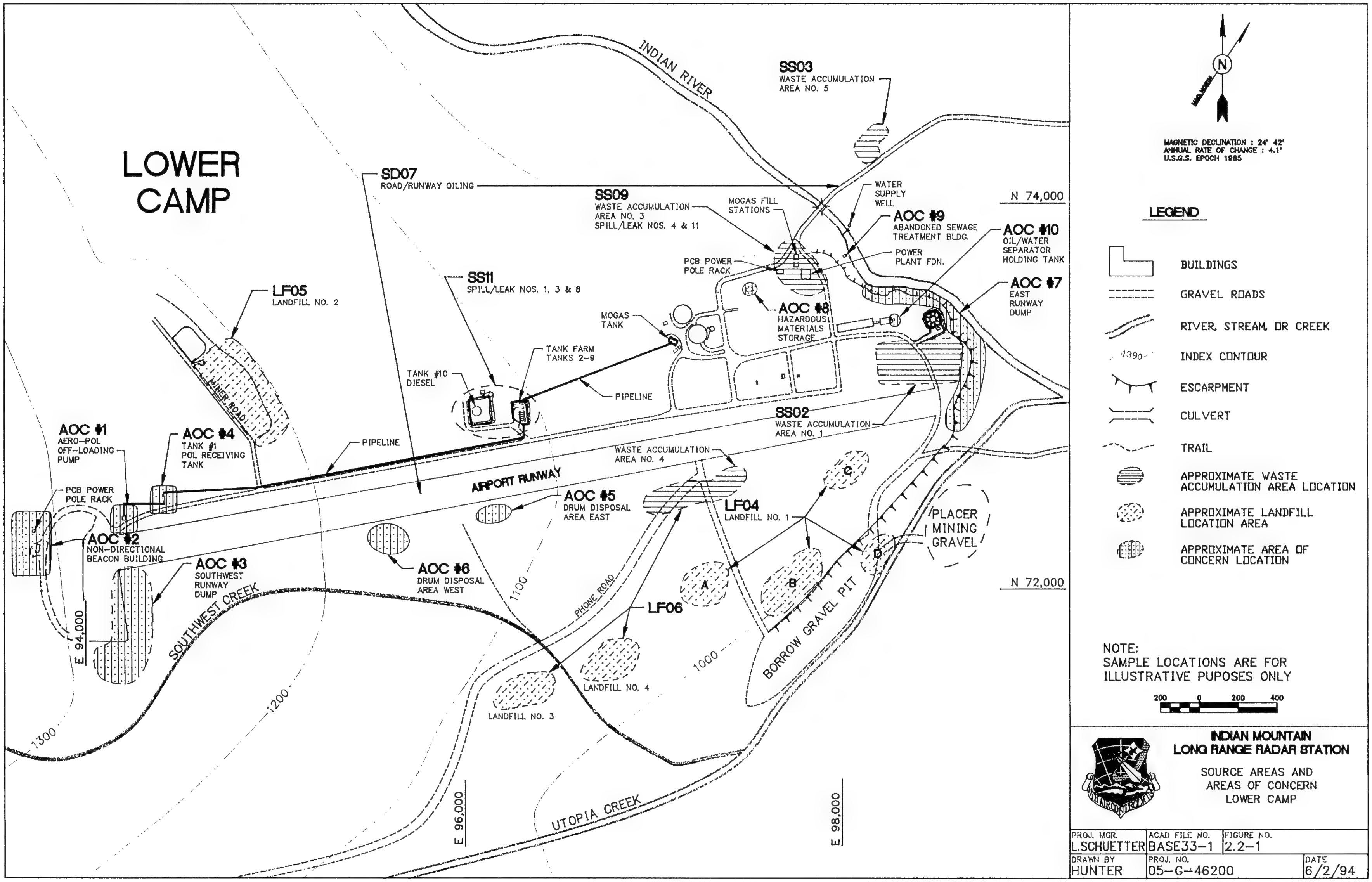
LF04 (landfill no. 1) is an area consisting of four disposal sites covering approximately one acre each. LF04 is located adjacent to a gravel borrow pit near Utopia Creek at Lower Camp. ES reported that this area consisted of one disposal area, landfill no. 1, and was used from 1953 to 1977 (Air Force 1985). During the 1994 site visit, three additional areas (A, C, and D) in the vicinity of landfill no. 1 (disposal area B) were identified. At landfill no. 1, fill depths range from 10 to 20 feet. ES also reports that wastes were burned regularly. The types of wastes buried at LF04 (disposal area B) include garbage, scrap lumber, metal from construction and demolition operations, and small quantities of shop waste such as paint cans, rags containing solvents and oils, and oil spill residues. ES also noted that road oiling was a regular practice during the period of operation, and it is unlikely that significant amounts of liquid industrial wastes were buried in LF04 (disposal area B). The three additional disposal areas (A, C, and D) identified in 1994 consisted of various types of exposed metal debris and drums. No soil staining was observed.

During the SI conducted by W-C in 1992, exposed debris and stained soil were not apparent at disposal site B. W-C collected a surface soil and subsurface soil sample from three locations at LF04 (disposal area B) during the SI, and the samples were analyzed for PCBs, pesticides, VOCs, SVOCs, and TAL metals. The pesticide 4,4'-DDT was detected in one of the three surface soil samples. Toluene was detected in two of the subsurface soil samples at very low estimated concentrations (0.1 and 0.3 micrograms per kilogram [μg/kg]). TAL metals were below action levels, with the exception of arsenic.

2.2.5 LF05 (Source 10: Landfill No. 2)

LF05 (landfill no. 2) covers an area of approximately 1 acre and is located just north of the runway along Miner Road. This landfill has been operating since 1977 and is still the active disposal site for the installation (Air Force 1993b). The landfill is used for disposal of incinerator ash, wood, metal, oil filters, empty drums, fuel absorbent, oil spill residue, paint residuals, and construction debris. Combustible materials are usually burned.

During the SI conducted by W-C in 1992, it was observed that the landfill cover surface consisted of gravels and cobbles. Vegetation was absent from the disturbed areas. Staining was not observed by the field team at this time. W-C collected co-located surface and subsurface samples from two locations. The subsurface samples were from depths of 2.0 feet to 2.8 feet. Surface soil samples were from depths of 0.5 foot. The soil samples were analyzed for PCBs, pesticides, VOCs, SVOCs, and TAL metals. The pesticides 4,4'-DDT, 4,4'DDD, and 4,4'-DDT were detected in all samples. One of the subsurface samples detected benzene, toluene, ethylbenzene, and toluene (BTEX) and tetrachloroethene (PCE), all of


LOWER CAMP
SD07 ROAD/RUNWAY OILING
SS09 WASTE ACCUMULATION AREA NO. 3 SPILL/LEAK NOS. 4 & 11
SS03 WASTE ACCUMULATION AREA NO. 5
INDIAN RIVER
MOGAS FILL STATIONS
WATER SUPPLY WELL
AOC #9 ABANDONED SEWAGE TREATMENT BLDG.
POWER PLANT FDN.
AOC #10 OIL/WATER SEPARATOR HOLDING TANK
AOC #7 EAST RUNWAY DUMP
PCB POWER POLE RACK
AOC #8 HAZARDOUS MATERIALS STORAGE
SS11 SPILL/LEAK NOS. 1, 3 & 8
MOGAS TANK
TANK FARM TANKS 2–9
TANK #10 DIESEL
PIPELINE
LF05 LANDFILL NO. 2
MINER ROAD
SS02 WASTE ACCUMULATION AREA NO. 1
WASTE ACCUMULATION AREA NO. 4
AOC #1 AERO–POL OFF–LOADING PUMP
AOC #4 TANK #1 POL RECEIVING TANK
PCB POWER POLE RACK
AOC #2 NON–DIRECTIONAL BEACON BUILDING
AIRPORT RUNWAY
AOC #5 DRUM DISPOSAL AREA EAST
LF04 LANDFILL NO. 1
AOC #3 SOUTHWEST RUNWAY DUMP
AOC #6 DRUM DISPOSAL AREA WEST
PLACER MINING GRAVEL
SOUTHWEST CREEK
PHONE ROAD
LF06
BORROW GRAVEL PIT
LANDFILL NO. 4
LANDFILL NO. 3
UTOPIA CREEK
A
B
C
D
1300
1200
1100
1000
E 94,000
E 96,000
E 98,000
N 74,000
N 72,000
N
MAGNETIC DECLINATION : 24° 42'
ANNUAL RATE OF CHANGE : 4.1'
U.S.G.S. EPOCH 1985
LEGEND
BUILDINGS
GRAVEL ROADS
RIVER, STREAM, OR CREEK
1390
INDEX CONTOUR
ESCARPMENT
CULVERT
TRAIL
APPROXIMATE WASTE ACCUMULATION AREA LOCATION
APPROXIMATE LANDFILL LOCATION AREA
APPROXIMATE AREA OF CONCERN LOCATION
NOTE:
SAMPLE LOCATIONS ARE FOR ILLUSTRATIVE PUPOSES ONLY
200 0 200 400
INDIAN MOUNTAIN
LONG RANGE RADAR STATION
SOURCE AREAS AND AREAS OF CONCERN LOWER CAMP
PROJ. MGR. L.SCHUETTER
ACAD FILE NO. BASE33–1
FIGURE NO. 2.2–1
DRAWN BY HUNTER
PROJ. NO. 05–G–46200
DATE 6/2/94

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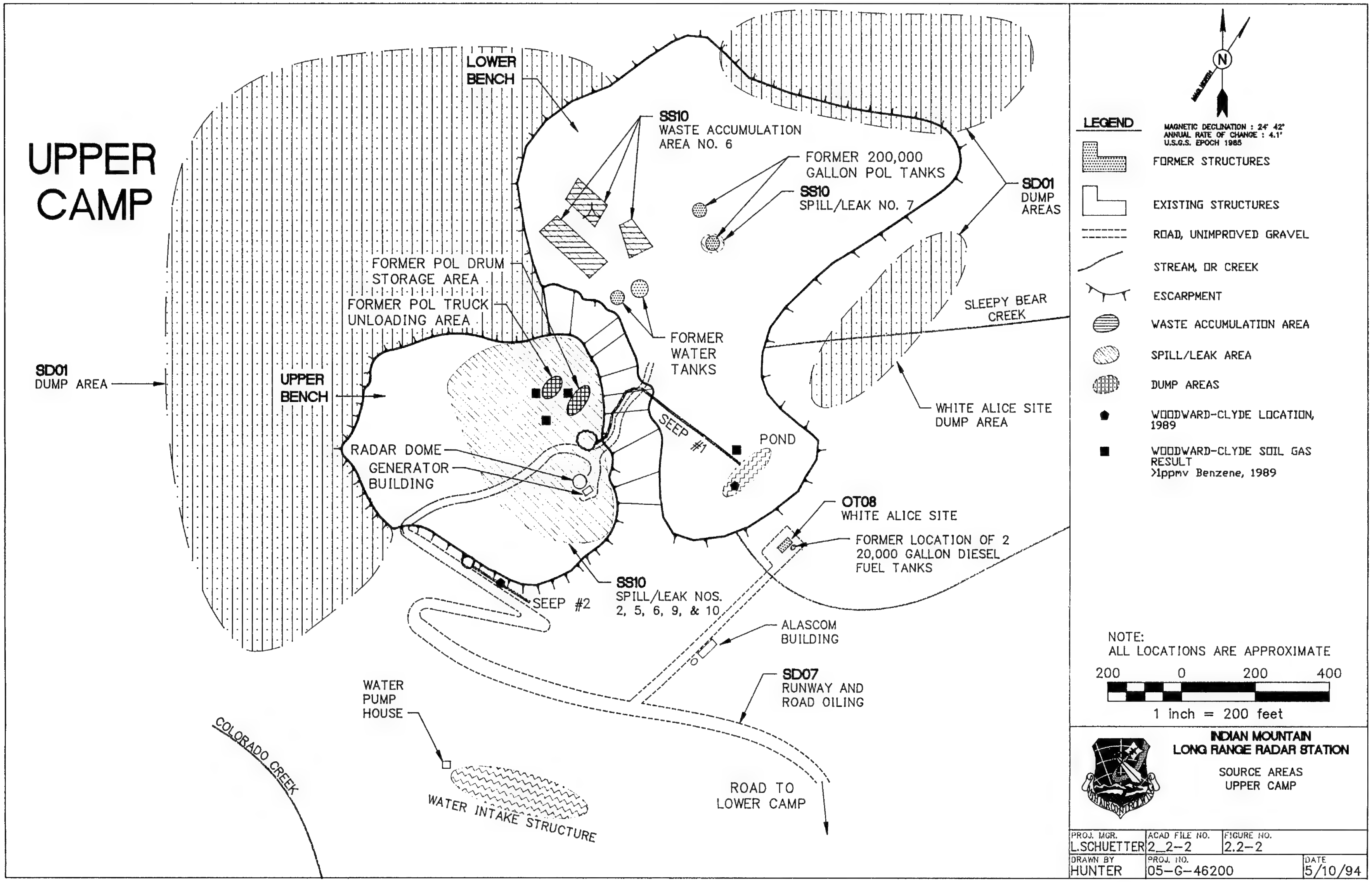

UPPER CAMP
SD01 DUMP AREA
LOWER BENCH
UPPER BENCH
SS10 WASTE ACCUMULATION AREA NO. 6
FORMER 200,000 GALLON POL TANKS
SS10 SPILL/LEAK NO. 7
SD01 DUMP AREAS
FORMER POL DRUM STORAGE AREA
FORMER POL TRUCK UNLOADING AREA
FORMER WATER TANKS
SLEEPY BEAR CREEK
WHITE ALICE SITE DUMP AREA
SEEP #1
POND
RADAR DOME
GENERATOR BUILDING
OT08 WHITE ALICE SITE
FORMER LOCATION OF 2 20,000 GALLON DIESEL FUEL TANKS
SEEP #2
SS10 SPILL/LEAK NOS. 2, 5, 6, 9, & 10
ALASCOM BUILDING
SD07 RUNWAY AND ROAD OILING
WATER PUMP HOUSE
COLORADO CREEK
WATER INTAKE STRUCTURE
ROAD TO LOWER CAMP
N
MAGNETIC DECLINATION : 24° 42'
ANNUAL RATE OF CHANGE : 4.1'
U.S.G.S. EPOCH 1985
LEGEND
FORMER STRUCTURES
EXISTING STRUCTURES
ROAD, UNIMPROVED GRAVEL
STREAM, OR CREEK
ESCARPMENT
WASTE ACCUMULATION AREA
SPILL/LEAK AREA
DUMP AREAS
WOODWARD-CLYDE LOCATION, 1989
WOODWARD-CLYDE SOIL GAS RESULT >1ppmv Benzene, 1989
NOTE:
ALL LOCATIONS ARE APPROXIMATE
200 0 200 400
1 inch = 200 feet
INDIAN MOUNTAIN LONG RANGE RADAR STATION
SOURCE AREAS UPPER CAMP
PROJ. MGR. L.SCHUETTER
ACAD FILE NO. 2_2-2
FIGURE NO. 2.2-2
DRAWN BY HUNTER
PROJ. NO. 05-G-46200
DATE 5/10/94

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which were at very low, estimated values except toluene. One other soil borehole contained carbon disulfide, toluene, and xylenes (total), all of which were at very low, estimated values. The remaining samples for which data are available, all detected tetrachloroethene at very low, estimated values. SVOCs were not detected in any samples. TAL metals were all below action levels, with the exception of arsenic. During the 1994 site visit, numerous exposed drums along the eastern edge of the landfill boundary were identified.

2.2.6 LF06 (Source 2: Waste Accumulation Area No. 4, Landfill No. 3, and Landfill No. 4)

Waste Accumulation Area No. 4. Waste accumulation area no. 4 was used in the 1950s and 1960s as a drum storage area for fuels or waste at Lower Camp. The dimensions of the area are not documented. W-C reports that during the 1992 SI numerous drums were observed to be scattered in the woods south of the waste accumulation area (Air Force 1993b). The W-C team did not observe stained soils at this location. The 1985 Records Search prepared by ES describes waste accumulation area No. 4 as an area on the south side of the runway where there was evidence that a large number of drums were at one time accumulated. Several barrels were scattered in the area at the time of the survey. ES reported that the area may have been used as a drum storage area for fuels before delivering the fuel in bulk quantities, and/or it may have been used to store wastes in drums (Air Force 1985).

During a site survey conducted by W-C in July 1990, the team observed potentially hundreds of 55 gallon drums lying off the south side runway. Some of the drums were partially buried, and the majority of the drums were empty. Several of the drums were observed to contain varying amounts of liquid (Air Force 1990). During the 1994 site visit, no drums were observed within the general area of waste accumulation area no. 4.

A surface soil and subsurface soil sample were collected from waste accumulation area no. 4 and analyzed for PCBs, pesticides, volatile organic compounds, semivolatile organic compounds, and TAL metals. The pesticides 4,4'-DDE, 4,4'-DDD, and 4,4'-DDT were detected at very low and estimated concentrations in both soil samples. Benzene was also detected in both samples at very low estimated concentrations. TAL metals in the soil samples were below action levels, with the exception of arsenic.

Landfill No. 3. Landfill no. 3 is an area approximately 0.2 acres in area at Lower Camp that was used during the period 1978 to 1980 to bury scrap metal, drums, wood, and other debris generated during a general cleanup of Lower Camp. W-C reports that the 1992 field team observed exposed debris; however, stains were not apparent (Air Force 1993b). The area was vegetated with native grasses and saplings. This landfill is adjacent to landfill no. 4. During the 1994 site visit, numerous exposed drums were observed downgradient of landfill no. 3 and within an adjacent drainage. Two metal tanks within a water-filled trench along the southern boundary were also identified.

A surface soil and subsurface soil sample were collected at landfill no. 3 during the 1992 SI conducted by W-C (Air Force 1993b). The samples were analyzed for PCBs, pesticides, volatile organic compounds, semivolatile organic compounds, and TAL metals. The pesticides 4,4'-DDE, 4,4'-DDD, and 4,4'-DDT were detected at estimated concentrations in both soil samples, and PCE was detected at very low

estimated concentrations in both samples. Semivolatile organic compounds were not detected in either soil sample. TAL metals were below action levels, with the exception of arsenic.

Landfill No. 4. Landfill no. 4 is located at the south end of the runway adjacent to landfill no. 3 at Lower Camp. It is approximately 0.2 acre in area. ES reports that the landfill was used to bury 50 to 100 drums found scattered in the immediate vicinity of the runway (from waste accumulation area no. 4) (Air Force 1985). ES observed numerous additional drums in the wooded area around the landfill. W-C (1993) reports that the drums were buried sometime in the 1970s, although the specific year is not known (Air Force 1993b). The type of waste contained in the drums is unknown.

W-C observed stained soil during the 1992 SI and noted that the area was vegetated with native grasses and saplings (Air Force 1993b). Numerous exposed drums surrounding landfill no. 4 and stained soils were observed during the 1994 site visit.

W-C collected one surface soil and one subsurface soil sample from three locations at landfill no. 4 during the 1992 SI. The pesticide 4,4'-DDT was detected in one surface soil sample at 2.2 μg/kg (estimated). Toluene was detected in two of the subsurface soil samples at 0.1 μg/kg (estimated) and 0.3 μg/kg (estimated). Semivolatile organic compounds were not detected in any of the soil samples. TAL metals were below action levels, with the exception of arsenic.

2.2.7 SD07 (Source 8: Runway/Road Oiling)

Waste oil and other shop wastes including solvents and ethylene glycol were routinely applied to roads for dust control and to dispose of the wastes from the 1950s until 1984. The runway and the road connecting Lower Camp to Upper Camp were the primary areas oiled.

Ten surface soil samples were collected from this source in 1992. Five samples were collected from the runway and five samples were collected from the road between the camps. The samples were analyzed for pesticides, PCBs and organics. The pesticides 4,4'-DDD and 4,4'-DDT were detected in runway samples. Three of the road samples and four of the runway samples contained measurable concentrations of some or all of the following contaminants: BTEX, PCE, chlorobenzene, and 1,2-dichloroethane. All results were estimated. Semivolatiles were not detected in any of the samples. Metals were not analyzed for in the SD07 samples.

2.2.8 OT08 (Source 11: White Alice Communications System)

The WACS for Indian Mountain was activated in 1958, deactivated in 1979, and demolished in 1986. The former location is topographically below the lower bench southeast of the existing radar dome.

According to the Phase I Records Search (Air Force 1985), information concerning removal of WACS equipment, oil, and soil was not extensive. File data reviewed by ES during the records search indicated that 85 drums of PCB-contaminated oil and 240 drums of PCB-contaminated soil were removed from the WACS site.

According to W-C personnel there is no evidence of the former structures or equipment. None of the Indian Mountain LRRS field investigations have included the former WACS site.

2.2.9 SS09 (Source 6: Waste Accumulation Area No. 3 and Spill/Leak Nos. 4 and 11)

Waste Accumulation Area No. 3. Waste accumulation area no. 3 is located north and west of the former power plant location, north of Lower Camp. The area was active from the 1950s until 1984. Waste oil, mogas, and other liquids were stored in aboveground storage tanks, which have been demolished. Some oil was removed from this area and shipped offsite for disposal in 1984. During the 1994 site visit, the former power plant cement foundation, mogas fill station cement foundations, soil staining, a PCB power pole rack, and a seep were identified. The mogas fill stations consisted of one flat cement foundation and one foundation with 3-foot side walls. The foundation with side walls contained standing water and a metal tank. Soil staining was observed on the hillside below a pipe coming out of the foundation. Reportedly, the mogas foundations were former sites of mogas storage, allocation, and spills and leaks.

Spill/Leak Nos. 4 and 11. Release No. 4 occurred in 1976 and consisted of a 4,000-gallon POL release from a tank at Building 110. The release, a tank overflow, was contained in the dike area surrounding the tank and 80 to 90 percent of the liquid was recovered. Leak no. 11 occurred over a long period of time and includes lines from the waste oil storage tank at the former power plant and fuel line leakage. Further information was not available. It is assumed that the fuel line releases occurred near the power plant. The tanks and fuel lines in this area have been demolished.

The area was described, during the SI conducted by W-C in 1992, as having a gravel surface with no vegetation (Air Force 1993b). Stained areas were not observed. The size of the area is not described and apparently there was some uncertainty as to the location of the area. Conversations with facility personnel after sampling had been completed indicated that the location of the source area may actually have been upgradient and west of the location that had been sampled (Air Force, 1993b). A co-located surface soil sample, at a depth of 0.5 foot, and a subsurface soil sample, from a depth of 2.5 feet, were collected. The soil samples were analyzed for PCBs, pesticides, VOCs, SVOCs, and TAL metals. The pesticides 4,4'-DDT and 4,4'-DDD were detected in both the surface and subsurface samples at very low, estimated values. The pesticide 4,4'-DDE was also detected in the subsurface sample at a very low, estimated value. TAL metals were all below action levels, with the exception of arsenic.

2.2.10 SS10 (Source 3: Waste Accumulation Area No. 6 and Spill/Leak Nos. 2, 5, 6, 7, 9, 10)

Waste Accumulation Area No. 6. Waste accumulation area no. 6 was used as the main drum accumulation area for the Upper Camp from the 1950s until the 1970s. Drums were stacked on the lower bench, just northeast and below the summit, and reportedly contained waste oil and other liquid wastes. The area was cleaned up in 1978 and 1980. Many drums from both the Upper and Lower camps were crushed and buried at two large Upper Camp locations during this cleanup effort.

Spill/Leak Nos. 2, 5, 6, 7, 9, and 10. Spill/leak nos. 2, 5, 6, 7, 9, and 10 were diesel fuel releases ranging in volume from 1,500 gallons to 46,500 gallons. These volumes were usually estimated from receiving reports and are tabulated below. A volume was not reported for leak no. 5. These releases occurred between 1973 and 1979. All of the buildings, tanks, and fuel lines associated with those releases have been demolished and buried.

Spill/Leak	Year	Volume Released (gallons)	Type of Release	Result
2	1973	3,500	Fuel line rupture at gym and radar operations	Fuel soaked into ground
5	1977-78	Unknown	Line leaks between bulk tanks and smaller storage tanks	Probably several thousand gallons leaked to ground
6	1977	3,000	Fuel line leak at Building 207	Fuel soaked into ground
7	1977	46,500	Released from open drain valve at a bulk tank	Fuel soaked into ground and periodically flowed on surface; some fuel burned on ground to minimize infiltration and runoff
9	1979	1,500	Fuel line leak at Building 221	Fuel likely soaked into ground
10	1979	7,800	Fuel line leaks between bulk tanks and Building 217	Fuel soaked into ground

Surface soil, surface water, seep, sediment, and soil gas samples have been collected at various Upper Camp locations during the three field investigations performed by W-C. Soil gas, surface soil, surface water, and sediment were sampled during the 1989 field investigation. The spill/leak area was not investigated after 1989.

The contaminants detected during previous investigations include benzene in soil gas and surface water; total petroleum hydrocarbons (TPH) in surface water and sediment; and PCBs, pesticides, and arsenic in soil. One surface soil sample was collected in the approximate location of waste accumulation area no. 6 during the W-C 1992 visit. Neither VOCs nor SVOCs were detected in this sample; only PCBs were detected. W-C interpreted from their 1991 soil gas results that diesel fuel was the dominant contaminant detected. Surface water and sediment samples collected in the primary Upper Camp drainage indicate the presence of TPH as measured

using Method 418.1. Because this method does not distinguish between petroleum hydrocarbons and naturally occurring organics, it is possible that the results are not valid as indicating the presence of fuel contaminants from this source. No background data have been collected for the Upper Camp.

Most of the landscape within the vicinity of the summit, about 10 acres, has been disturbed by construction or demolition activities. Where undisturbed, the ground is typically tundra. The tundra consists primarily of sedges, very low willows, cranberry, mountain avens, cassiope, and lichen (Air Force 1991a).

2.2.11 SS11 (Source 1: Spill/Leak Nos. 1, 3, and 8)

SS11 includes spill and leak nos. 1, 3, and 8 that occurred at POL tanks 2 through 10 at the Lower Camp. The tanks are adjacent to the north side of the runway about halfway down the length of the runway. Tanks 2 through 6 are each 12,220-gallon diesel bulk storage tanks. Tank 7 is a 10,126-gallon diesel bulk storage tank, and tanks 8 and 9 are each 33,362-gallon diesel bulk storage tanks. Tank 10, which has been deactivated but is still in place, is a 435,761-gallon diesel bulk storage tank. Diesel fuel releases in this area are summarized below:

Spill/Leak	Year	Volume Released (gallons)	Type of Release	Result
1	1973	29,000	Rupture of fuel bladder	Approximately 80% of the fuel was recovered
3	1974	33,000	Fuel bladder leak	Contained in dike area; recovered 80-90%
8	1977	3,500	Tank overflow	Absorbents applied but most of the fuel soaked into the ground; absorbents and some soil removed and put in a landfill

Environmental samples have not been collected at the bulk fuel area. The Phase I report (Air Force 1985) recommended that the area be investigated although none of the field investigations conducted after 1985 included this site. This source has not been previously investigated. During the 1994 site visit, no impermeable liners within the bermed areas were identified. Drainage pipes were identified for each bermed area leading to soils outside the bermed areas.

2.3 CONCEPTUAL SITE MODEL

Conceptual site models (CSMs) have been developed for both Upper Camp and Lower Camp at Indian Mountain LRRS. The CSMs generally identify contaminants present, contaminant sources, release mechanisms, contaminant transport media, exposure routes, and receptors.

Only two CSMs have been developed, one for Upper Camp and one for Lower Camp. In general, the sources at each of the two sites are located fairly close to each other, are similar in the nature of potential contaminants, and affect the same

potential pathways and receptors. Furthermore, validated data are available for only a limited number of source areas, so individual CSMs could only be formulated for those areas.

The data to support the CSMs for Upper and Lower Camp were summarized from the results of the 1992 SI conducted by W-C (Air Force 1993b). These data are the only validated data available for the Indian Mountain LRRS. Additional soil gas and water and sediment headspace sample results are available for Upper Camp; however, the analytical results are not of sufficient quality to support the preparation of the CSMs. These screening-level results have been used to the extent possible to determine potential sample locations for the 1994 RI, but do not provide the type of information necessary to develop the site-specific CSMs.

Table 2.3-1 and Table 2.3-2 provide summaries of the validated data collected during the 1992 SI at sources and background locations, source descriptions, potential migration pathways, exposed populations, and Preliminary Remediation Goals (PRGs) for the respective camps.

Background concentrations (where available), general migration pathways, exposed populations, and target risk levels are identified only for the Upper Camp and Lower Camp CSMs, rather than for individual source areas. However, data regarding observed contaminants and contaminated media are identified for individual source areas. Following the additional data collection planned for the summer of 1994, it will be possible to formulate CSMs for individual source areas, and to group different source areas together as appropriate. Such activities are premature at this time.

2.3.1 Upper Camp Conceptual Site Model

The following sections present information used to prepare the conceptual site model specifically for Upper Camp.

2.3.1.1 Upper Camp Description

Upper Camp is located at the summit of Indian Mountain. It has been and is currently the location of the radar equipment. A radar dome and a small building for a backup generator are the only remaining structures. Upper Camp consists of an upper bench and a lower bench. The lower bench is located immediately northeast of the upper bench. The old WACS was previously located near the summit of Indian Mountain, approximately 500 feet southeast of the upper bench. A water intake structure is located about one-half mile south-southeast of the upper bench. This structure formerly contained drinking water for Upper Camp use. Although no longer used for drinking water supply, the structure still contains water and could receive runoff or groundwater discharge from Upper Camp or the road. Four contaminant sources have been identified at Upper Camp. These sources are described below. Detailed source descriptions are included in Section 2.2. Source locations are shown on Figure 2.2-2.

- SD01 (Source 9: Dump Areas) includes the areas used to dispose of rubbish, wood, metal, drums, plastic, and other debris on the eastern and western slopes of the mountain.

- SD07 (Source 8: Runway/Road Oiling) includes the road from Upper Camp to Lower Camp. Waste oil and other liquids accumulated through activities at

TABLE 2.3-1
INDIAN MOUNTAIN LRRS CONCEPTUAL SITE MODEL SUMMARY
UPPER CAMP
BACKGROUND CONTAMINANT CONCENTRATIONS

Current Site ID	Previous Site Identification	Site Description	Contaminants and Contaminated Media	Background Concentrations	Migration Pathway	Exposed Population	Target Risk Levels (1)
SS10	**UPPER CAMP** **Source 3:** Waste Accumulation Area No. 6 and Spill/Leak Nos. 2, 5, 6, 7, 9, and 10	Waste accumulation Area No. 6 was used as main drum accumulation area from 1950s to 1970s. Drums contained liquid wastes. Area was cleaned up 1978 to 1980. Spills and leaks are diesel fuel released from lines and drain valves and occurred during the 1970s.	Surface Soil Arochlor 1260 260J ug/kg VOCs ND SVOCs ND Inorganics: aluminum 20600 mg/kg arsenic 4.3 mg/kg barium 391 mg/kg beryllium 0.75J mg/kg cadmium 0.76J mg/kg calcium 7400 mg/kg chromium 17.2 mg/kg cobalt 11.5J mg/kg copper 50.4 mg/kg iron 26800 mg/kg lead 34.3 mg/kg magnesium 9910 mg/kg manganese 389 mg/kg nickel 15.8 mg/kg potassium 3200 mg/kg sodium 1210 mg/kg vanadium 66.9 mg/kg zinc 111 mg/kg	Surface Soil No background surface soil samples have been collected at Upper Camp. Subsurface Soil No background subsurface soil samples have been collected at Upper Camp. Surface Water No background surface water samples have been collected at Upper Camp. Groundwater No background groundwater samples have been collected at Upper Camp.	For all sources: SW, GW, Air, Contaminated Biota	For all sources: Human Contractor residents and transients via dermal contact, inhalation, and ingestion. Ecological Terrestrial and aquatic receptors via ingestion, inhalation and dermal contact	Soil and Sediment Arochlor 1260 1.3E+03 ug/kg C benzene 3.4E+05 ug/kg C PCE 1.9E+05 ug/kg C PCE 2.8E+07 ug/kg NC toluene 5.7E+08 ug/kg NC xylenes 5.7E+09 ug/kg NC chlorobenzene 5.7E+07 ug/kg NC Inorganics: aluminum Nontoxic trace element arsenic 5.7E+00 mg/kg C arsenic 8.5E+02 mg/kg NC barium 2.0E+05 mg/kg NC beryllium 2.3E+00 mg/kg C beryllium 1.4E+04 mg/kg NC cadmium 2.8E+03 mg/kg NC calcium Nontoxic trace element chromium 1.4E+04 mg/kg NC cobalt No toxicity values available copper 1.1E+05 mg/kg NC iron Nontoxic trace element lead EPA model required to to determine risk magnesium Nontoxic trace element manganese 4.0E+05 mg/kg NC nickel 5.7E+04 mg/kg NC potassium Nontoxic trace element

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TABLE 2.3–1 (continued)
INDIAN MOUNTAIN LRRS CONCEPTUAL SITE MODEL SUMMARY
UPPER CAMP
BACKGROUND CONTAMINANT CONCENTRATIONS

Current Site ID	Previous Site Identification	Site Description	Contaminants and Contaminated Media	Background Concentrations	Migration Pathway	Exposed Population	Target Risk Levels (1)
SD07	**Source 8:** Road Oiling	Waste fluids were used on road for dust control. Waste fluids consisted of oils, solvents, ethylene glycol, and other shop residues.	Surface Soil Arochlor 1260 ND–14J μg/kg PCE ND–0.9J μg/kg benzene ND–0.3J μg/kg toluene ND–1J μg/kg ethylbenzene ND–8J μg/kg xylenes ND–6J μg/kg chlorobenzene ND–0.2J μg/kg SVOCs ND Samples were not analyzed for TAL metals.				sodium Nontoxic trace element vanadium 2.0E+04 mg/kg NC zinc 8.5E+05 mg/kg NC
SD01	**Source 9:** Dump Areas	Areas used to dispose of rubbish, wood, metal, drums, plastic, and other debris on the eastern and western slopes of the mountain.	Samples have not been collected for Source 9.				
OT08	**Source 11:** White Alice Site	Radar/Communications facility used from 1958 to 1979. PCB oil leaks suspected. Area was demolished, burned, and buried onsite.	Samples have not been collected at Source 11.				

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TABLE 2.3-1 (continued)
INDIAN MOUNTAIN LRRS CONCEPTUAL SITE MODEL SUMMARY
UPPER CAMP
BACKGROUND CONTAMINANT CONCENTRATIONS

Current Site ID	Previous Site Identification	Site Description	Contaminants and Contaminated Media	Background Concentrations	Migration Pathway	Exposed Population	Target Risk Levels (1)

Notes:

(1) Target risk levels are based on the concentrations corresponding to a carcinogenic risk of 1.0E-06 (1x10-06) and a noncarcinogenic hazard quotient of 1.

(2) Analytical results from the September 1992 field investigation conducted by Woodward-Clyde Consultants were validated and are summarized in this table.
Analytical results from other past field investigations have not been validated and are not included in the table.
Applicable or Relevant and Appropriate Requirements (ARARs) for the detected compounds are summarized in Section 2.5.
All contaminant concentrations detected in the samples collected in September 1993 are below ARARS.
Indicates contaminant concentrations that were detected above the target risk level.

(3)
C = Carcinogenic target risk concentration
GW = groundwater
ID = Identification
J = estimated concentration
NC = Noncarcinogenic target risk concentration
PCB = polychlorinated biphenyls
PCE = tetrachloroethene
SVOCs = Semivolatile Organic Compounds
SW = surface water
TAL = Target Analyte List
VOCs = Volatile Organic Compounds

Source: Air Force 1993b

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TABLE 2.3-2 (continued)
INDIAN MOUNTAIN LRRS CONCEPTUAL SITE MODEL SUMMARY
LOWER CAMP
BACKGROUND CONTAMINANT CONCENTRATIONS

Current Site Identification	Previous Site Identification	Site Description	Contaminants and Contaminated Media	Background Concentrations	Migration Pathway	Exposed Population	Target Risk Levels (1)
S11	**LOWER CAMP** **Source 1:** Spill/Leak Nos. 1, 3, and 8	Diesel fuel releases associated with POL tanks adjacent to the north side of the runway.	Samples have not been collected at Source 1.	Surface Soil alpha-BHC 8.7J ug/kg aldrin 8.3 ug/kg 4,4'-DDE 26J ug/kg 4,4'-DDD 5.8J ug/kg 4,4'-DDT 200J ug/kg Note: Background surface soil samples were not analyzed for volatile and semivolatile organics. Inorganics: aluminum 970 mg/kg barium 77.1J mg/kg calcium 2930J mg/kg copper 7.1J mg/kg iron 1400 mg/kg lead 16 mg/kg magnesium 801J mg/kg manganese 106 mg/kg potassium 1080J mg/kg vanadium 41J mg/kg zinc 32.9 mg/kg Subsurface Soil 4,4'-DDT 1.2J ug/kg Note: Background subsurface soil samples were not analyzed for volatile and semivolatile organics. Inorganics: aluminum 5540 mg/kg arsenic 2.6J mg/kg barium 93.3 mg/kg calcium 1600 mg/kg	For all Sources: SW, GW, Air, Contaminated Biota	For All Sources: Human Contractor residents and transients via dermal contact, inhalation and ingestion. Ecological Terrestrial and aquatic receptors via ingestion, inhalation and dermal contact.	Soil and Sediment alpha-BHC 1.63E+03 ug/kg C aldrin 5.8E+02 ug/kg C aldrin 8.5E+04 ug/kg NC 4,4'-DDE 2.9E+04 ug/kg C 4,4'-DDD 4.1E+04 ug/kg C 4,4'-DDT 2.9E+04 ug/kg C 4,4'-DDT 1.4E+06 ug/kg NC 1,2-DCA 1.1E+05 ug/kg C benzene 3.4E+05 ug/kg C PCE 1.9E+05 ug/kg C PCE 2.8E+07 ug/kg NC toluene 5.7E+08 ug/kg NC xylenes 5.7E+09 ug/kg NC carbon disulfide 2.8E+08 ug/kg NC ethylbenzene 2.8E+08 ug/kg NC chlorobenzene 5.7E+07 ug/kg NC N-nitroso-diphenylamine 2.0E+06 ug/kg C phenanthrene No toxicity values available fluoranthene 1.1E+08 ug/kg NC phenol 1.7E+09 ug/kg NC Inorganics: aluminum Non-toxic trace element arsenic 5.7E+00 mg/kg C arsenic 8.5E+02 mg/kg NC barium 2.0E+05 mg/kg NC beryllium 2.3E+00 mg/kg C beryllium 1.4E+04 mg/kg NC cadmium 2.8E+03 mg/kg NC calcium Non-toxic trace element
LF06	**Source 2:** Waste Accumulation Area No. 4	Drum storage area used during the 1950s and 1960s for fuel/waste.	Surface Soil 4,4'-DDE 4.1J ug/kg 4,4'-DDD 7.1 ug/kg 4,4'-DDT 27J ug/kg benzene 14J ug/kg SVOCs ND Inorganics: aluminum 26,000 mg/kg arsenic 9.8 mg/kg barium 238 mg/kg beryllium 1.1J mg/kg cadmium 0.56J mg/kg calcium 6670 mg/kg chromium 39.5 mg/kg cobalt 14.7 mg/kg copper 38.1 mg/kg iron 38700 mg/kg lead 10.1 mg/kg magnesium 9020 mg/kg manganese 631 mg/kg nickel 31.7 mg/kg potassium 630J mg/kg sodium 519J mg/kg vanadium 86.9 mg/kg zinc 76.6 mg/kg				

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TABLE 2.3–2 (continued)
INDIAN MOUNTAIN LRRS CONCEPTUAL SITE MODEL SUMMARY
LOWER CAMP
BACKGROUND CONTAMINANT CONCENTRATIONS

Current Site Identification	Previous Site Identification	Site Description	Contaminants and Contaminated Media	Background Concentrations	Migration Pathway	Exposed Population	Target Risk Levels (1)
			Subsurface Soil 4,4'–DDT 2.7J ug/kg benzene 1J ug/kg SVOCs ND Inorganics: aluminum 26,500 mg/kg arsenic 7.5 mg/kg barium 274 mg/kg beryllium 1.1J mg/kg cadmium 0.68J mg/kg calcium 7430 mg/kg chromium 29.1 mg/kg cobalt 18.3 mg/kg copper 40.2 mg/kg iron 40900 mg/kg lead 7.2 mg/kg magnesium 9140 mg/kg manganese 847 mg/kg nickel 30.5 mg/kg potassium 631J mg/kg sodium 501J mg/kg vanadium 92.8 mg/kg zinc 77.2 mg/kg	chromium 5.5 mg/kg cobalt 3.8J mg/kg copper 5.5J mg/kg iron 7000 mg/kg lead 6.3 mg/kg magnesium 1060J mg/kg manganese 36.9 mg/kg nickel 5.3J mg/kg potassium 303J mg/kg sodium 466J mg/kg vanadium 14.6 mg/kg zinc 15.2 mg/kg Surface Water No background samples have been collected.			chromium 1.4E+04 mg/kg NC cobalt No toxicity values available copper 1.1E+05 mg/kg NC iron Non–toxic trace element lead EPA model required to to determine risk magnesium Non–toxic trace element manganese 4.0E+05 mg/kg NC mercury 8.5E+02 mg/kg NC nickel 5.7E+04 mg/kg NC potassium Non–toxic trace element sodium Non–toxic trace element vanadium 2.0E+04 mg/kg NC zinc 8.5E+05 mg/kg NC
LF06	Landfill No. 3	A 0.2–acre area used for burying scrap metal, drums, wood, and materials generated during the cleanup of Lower Camp from 1978 to 1980.	Surface Soil 4,4'–DDE 33J ug/kg 4,4'–DDD 270J ug/kg 4,4'–DDT 240J ug/kg PCE 1J ug/kg SVOCs ND Inorganics: aluminum 25200 mg/kg arsenic 8.5 mg/kg	Sediment *Utopia Creek* Pest./PCBs ND Note: Background samples were not analyzed for VOCs and SVOCs. *Indian River* Pest./PCBs ND Note: Background samples were not analyzed for VOCs and SVOCs.			Groundwater and Surface Water calcium Non–toxic trace element copper 1.5E+03 ug/l NC iron Non–toxic trace element magnesium

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TABLE 2.3−2 (continued)
INDIAN MOUNTAIN LRRS CONCEPTUAL SITE MODEL SUMMARY
LOWER CAMP
BACKGROUND CONTAMINANT CONCENTRATIONS

Current Site Identification	Previous Site Identification	Site Description	Contaminants and Contaminated Media			Background Concentrations			Migration Pathway	Exposed Population	Target Risk Levels (1)			
			barium	199	mg/kg	Inorganics (Utopia Creek):						Non−toxic trace		
			beryllium	1.1J	mg/kg	aluminum	14400	mg/kg			sodium	element		
			cadmium	0.56J	mg/kg	antimony	4.7J	mg/kg				Non−toxic trace		
			calcium	8200	mg/kg	arsenic	10.5	mg/kg			zinc	element		
			chromium	21.4	mg/kg	barium	160	mg/kg				1.1E+04	ug/l	NC
			cobalt	15.5	mg/kg	beryllium	0.83J	mg/kg						
			copper	26.9	mg/kg	cadmium	1.7	mg/kg						
			iron	36700	mg/kg	calcium	6020	mg/kg						
			lead	33.2	mg/kg	chromium	8.2	mg/kg						
			magnesium	9880	mg/kg	cobalt	14.7	mg/kg						
			manganese	687	mg/kg	copper	74.6	mg/kg						
			nickel	20.7	mg/kg	iron	31700	mg/kg						
			potassium	616J	mg/kg	lead	47	mg/kg						
			selenium	0.65J	mg/kg	magnesium	9310	mg/kg						
			sodium	537J	mg/kg	manganese	684	mg/kg						
			vanadium	92	mg/kg	nickel	8.4J	mg/kg						
			zinc	86.5	mg/kg	potassium	301J	mg/kg						
						selenium	0.65J	mg/kg						
						sodium	427J	mg/kg						
			Subsurface Soil			vanadium	66.8	mg/kg						
			4,4'−DDE	13J	ug/kg	zinc	397	mg/kg						
			4,4'−DDD	130J	ug/kg									
			4,4'−DDT	93J	ug/kg									
			PCE	3J	ug/kg									
			SVOCs	ND										
						Inorganics (Indian River):								
			Inorganics:			aluminum	24900	mg/kg						
			aluminum	24000	mg/kg	arsenic	4.9	mg/kg						
			arsenic	6.2	mg/kg	barium	294	mg/kg						
			barium	229	mg/kg	beryllium	0.99J	mg/kg						
			beryllium	1J	mg/kg	calcium	7190	mg/kg						
			cadmium	0.65J	mg/kg	chromium	24.7	mg/kg						
			calcium	9930	mg/kg	cobalt	14.8J	mg/kg						
			chromium	21.6	mg/kg	copper	34.7	mg/kg						
			cobalt	14.4	mg/kg	iron	32600	mg/kg						
			copper	25.3	mg/kg	lead	8.6	mg/kg						
			iron	36000	mg/kg	magnesium	8000	mg/kg						
			lead	37.5	mg/kg	manganese	797	mg/kg						
			magnesium	8830	mg/kg	nickel	23.6	mg/kg						

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TABLE 2.3–2 (continued)
INDIAN MOUNTAIN LRRS CONCEPTUAL SITE MODEL SUMMARY
LOWER CAMP
BACKGROUND CONTAMINANT CONCENTRATIONS

Current Site Identification	Previous Site Identification	Site Description	Contaminants and Contaminated Media			Background Concentrations			Migration Pathway	Exposed Population	Target Risk Levels (1)
			manganese	743	mg/kg	potassium	1150J	mg/kg			
			mercury	0.48	mg/kg	sodium	1050J	mg/kg			
			nickel	19.5	mg/kg	vanadium	74.1	mg/kg			
			potassium	334J	mg/kg	zinc	80.9	mg/kg			
			sodium	497J	mg/kg						
			vanadium	78.8	mg/kg						
			zinc	91.9	mg/kg						
LF06	Landfill No. 4	A landfill approximately the same size as Landfill No. 3 located adjacent to Landfill No. 3. Used in the 1970s to bury 50 to 100 drums found along the runway. The types of waste are unknown.	Surface Soil								
			Pest./PCBs	ND							
			VOCs	Data not usable		Groundwater					
			SVOCs	ND		No background samples have been collected.					
			Inorganics:								
			aluminum	19100	mg/kg						
			arsenic	6.6	mg/kg						
			barium	250	mg/kg						
			beryllium	0.78J	mg/kg						
			calcium	4830	mg/kg						
			chromium	21	mg/kg						
			cobalt	10.6J	mg/kg						
			copper	21.4	mg/kg						
			iron	29500	mg/kg						
			lead	40.6	mg/kg						
			magnesium	5770	mg/kg						
			manganese	389	mg/kg						
			nickel	15.2	mg/kg						
			potassium	585J	mg/kg						
			sodium	528J	mg/kg						
			vanadium	65.4	mg/kg						
			zinc	113	mg/kg						
			Subsurface Soil								
			Pest./PCBs	ND							
			toluene	1J	ug/kg						
			xylenes	4J	ug/kg						
			N–nitroso–di–phenylamine	500J	ug/kg						

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TABLE 2.3–2 (continued)
INDIAN MOUNTAIN LRRS CONCEPTUAL SITE MODEL SUMMARY
LOWER CAMP
BACKGROUND CONTAMINANT CONCENTRATIONS

Current Site Identification	Previous Site Identification	Site Description	Contaminants and Contaminated Media			Background Concentrations	Migration Pathway	Exposed Population	Target Risk Levels (1)
			phenanthrene	650J	ug/kg				
			fluoranthene	400J	ug/kg				
			Inorganics:						
			aluminum	23700	mg/kg				
			arsenic	7.1	mg/kg				
			barium	181	mg/kg				
			beryllium	0.94J	mg/kg				
			calcium	7130	mg/kg				
			chromium	25.6	mg/kg				
			cobalt	11J	mg/kg				
			copper	19.5	mg/kg				
			iron	33100	mg/kg				
			lead	9.2	mg/kg				
			magnesium	7040	mg/kg				
			manganese	577	mg/kg				
			nickel	21.7	mg/kg				
			potassium	573J	mg/kg				
			sodium	524J	mg/kg				
			vanadium	72.9	mg/kg				
			zinc	70	mg/kg				
	Source 4:								
LF04	Landfill No. 1	An approx. 1–acre area operated from 1953 to 1977. Fill depth was 10 to 20 feet. Wastes buried include garbage, scrap metal, lumber, and small quantities of shop wastes. The landfill is located near Utopia Creek.	Surface Soil						
			4,4'–DDT	ND–2.2J	ug/kg				
			VOCs	ND					
			SVOCs	ND					
			Inorganics:						
			aluminum	20500–29400	mg/kg				
			arsenic	7–7.8	mg/kg				
			barium	122–291	mg/kg				
			beryllium	0.85J–1.4	mg/kg				
			cadmium	ND–0.7J	mg/kg				
			calcium	2460–7210	mg/kg				
			chromium	26–31	mg/kg				
			cobalt	9.6J–23.3	mg/kg				
			copper	19.6–45.8	mg/kg				
			iron	33300–48300	mg/kg				

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TABLE 2.3–2 (continued)
INDIAN MOUNTAIN LRRS CONCEPTUAL SITE MODEL SUMMARY
LOWER CAMP
BACKGROUND CONTAMINANT CONCENTRATIONS

Current Site Identification	Previous Site Identification	Site Description	Contaminants and Contaminated Media			Background Concentrations	Migration Pathway	Exposed Population	Target Risk Levels (1)
			lead	8.5–11	mg/kg				
			magnesium	5780–12100	mg/kg				
			manganese	289–1250	mg/kg				
			nickel	23.1–30.7	mg/kg				
			potassium	513J–660J	mg/kg				
			sodium	490J–548J	mg/kg				
			vanadium	62.2–120	mg/kg				
			zinc	66.4–78.9	mg/kg				
			Subsurface Soil						
			Pest./PCBs	ND					
			toluene	ND–0.3J	ug/kg				
			SVOCs	ND					
			Inorganics:						
			aluminum	22400–27200	mg/kg				
			antimony	ND–8J	mg/kg				
			arsenic	5.8–12.6	mg/kg				
			barium	199–258	mg/kg				
			beryllium	0.98J–1.2	mg/kg				
			cadmium	0.49J–0.68J	mg/kg				
			calcium	5110–8760	mg/kg				
			chromium	21.4–27.6	mg/kg				
			cobalt	15.5–18.9	mg/kg				
			copper	32.1–55.2	mg/kg				
			iron	35100–42000	mg/kg				
			lead	10.3–13.8	mg/kg				
			magnesium	8260–11200	mg/kg				
			manganese	627–987	mg/kg				
			mercury	ND–0.3	mg/kg				
			nickel	19.2–30.5	mg/kg				
			potassium	338J–611J	mg/kg				
			sodium	380J–552J	mg/kg				
			vanadium	73–113	mg/kg				
			zinc	65.8–86.7	mg/kg				

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TABLE 2.3–2 (continued)
INDIAN MOUNTAIN LRRS CONCEPTUAL SITE MODEL SUMMARY
LOWER CAMP
BACKGROUND CONTAMINANT CONCENTRATIONS

Current Site Identification	Previous Site Identification	Site Description	Contaminants and Contaminated Media	Background Concentrations	Migration Pathway	Exposed Population	Target Risk Levels (1)
SS02	**Source 5:** Waste Accumulation Area No. 1	Area used from 1950s to mid 1980s to store drums of waste before off–site disposal.	Surface Soil 4,4'–DDE ND–44J ug/kg 4,4'–DDD ND–140J ug/kg 4,4'–DDT 11J–580J ug/kg PCE ND–0.7J ug/kg Note: VOCs for one sample were listed as "not received." SVOCs ND Inorganics: aluminum 19700–24500 mg/kg arsenic 8.3–10.4 mg/kg barium 128–295 mg/kg beryllium 0.89J–0.91J mg/kg cadmium 0.6J–0.68J mg/kg calcium 1750–7020 mg/kg chromium 18.2–28 mg/kg cobalt 13.4–23.8 mg/kg copper 29.6–31.4 mg/kg iron 34200–37300 mg/kg lead 12.8–28.9 mg/kg magnesium 6710–9480 mg/kg manganese 571–1580 mg/kg nickel 16.6–34.7 mg/kg potassium 533J–636J mg/kg sodium 497J–507J mg/kg vanadium 70–87.6 mg/kg zinc 81.3–219 mg/kg Subsurface Soil 4,4'–DDE ND–8J ug/kg 4,4'–DDD ND–28J ug/kg 4,4'–DDT ND–270J ug/kg PCE ND–0.7J ug/kg SVOCs ND				

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TABLE 2.3–2 (continued)
INDIAN MOUNTAIN LRRS CONCEPTUAL SITE MODEL SUMMARY
LOWER CAMP
BACKGROUND CONTAMINANT CONCENTRATIONS

Current Site Identification	Previous Site Identification	Site Description	Contaminants and Contaminated Media			Background Concentrations	Migration Pathway	Exposed Population	Target Risk Levels (1)
			Inorganics:						
			aluminum	15700–18800	mg/kg				
			antimony	3.9J–4.1J	mg/kg				
			arsenic	10.1–10.7	mg/kg				
			barium	146–215	mg/kg				
			beryllium	0.72J–0.74J	mg/kg				
			cadmium	ND–0.46J	mg/kg				
			calcium	1650–4480	mg/kg				
			chromium	23.5–26	mg/kg				
			cobalt	11.4–14.2	mg/kg				
			copper	25.6–28	mg/kg				
			iron	27000–30100	mg/kg				
			lead	10.4–17.1	mg/kg				
			magnesium	5820–6770	mg/kg				
			manganese	438–685	mg/kg				
			nickel	21.1–25.5	mg/kg				
			potassium	559J–622J	mg/kg				
			sodium	413J–447J	mg/kg				
			vanadium	57.1–57.9	mg/kg				
			zinc	65–88.1	mg/kg				
SS09	**Source 6:** Waste Accumulation Area No. 3 and Spill/Leak Nos. 4 and 11	Area used to store waste oils and other liquids in ASTs from 1950s to 1984. Some oils have been re–moved. Spills and leaks are releases of fuel from a tank at Building 110 and lines from the waste oil storage tank at the former power plant.	Surface Soil						
			4,4'–DDD	40J	ug/kg				
			4,4'–DDT	300J	ug/kg				
			VOCs	ND					
			SVOCs	ND					
			Inorganics:						
			aluminum	21300	mg/kg				
			arsenic	8.9	mg/kg				
			barium	600	mg/kg				
			beryllium	0.99J	mg/kg				
			cadmium	0.81J	mg/kg				
			calcium	8030	mg/kg				
			chromium	24.5	mg/kg				
			cobalt	16	mg/kg				
			copper	42.2	mg/kg				

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TABLE 2.3–2 (continued)
INDIAN MOUNTAIN LRRS CONCEPTUAL SITE MODEL SUMMARY
LOWER CAMP
BACKGROUND CONTAMINANT CONCENTRATIONS

Current Site Identification	Previous Site Identification	Site Description	Contaminants and Contaminated Media			Background Concentrations	Migration Pathway	Exposed Population	Target Risk Levels (1)
			iron	38700	mg/kg				
			lead	24	mg/kg				
			magnesium	11000	mg/kg				
			manganese	712	mg/kg				
			nickel	15.6	mg/kg				
			potassium	577J	mg/kg				
			vanadium	94.3	mg/kg				
			zinc	152	mg/kg				
			Subsurface Soil						
			4,4'–DDE	1.4J	ug/kg				
			4,4'–DDD	9.3J	ug/kg				
			4,4'–DDT	16J	ug/kg				
			VOCs	ND	ug/kg				
			phenol	230J	ug/kg				
			Inorganics:						
			aluminium	21500	mg/kg				
			arsenic	11.5	mg/kg				
			barium	164	mg/kg				
			beryllium	0.81J	mg/kg				
			calcium	3080	mg/kg				
			chromium	23.7	mg/kg				
			cobalt	9.5J	mg/kg				
			copper	30.2	mg/kg				
			iron	29300	mg/kg				
			lead	10.1	mg/kg				
			magnesium	7140	mg/kg				
			manganese	330	mg/kg				
			nickel	19.4	mg/kg				
			potassium	886J	mg/kg				
			sodium	510J	mg/kg				
			vanadium	81.6	mg/kg				
			zinc	59.2	mg/kg				

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TABLE 2.3–2 (continued)
INDIAN MOUNTAIN LRRS CONCEPTUAL SITE MODEL SUMMARY
LOWER CAMP
BACKGROUND CONTAMINANT CONCENTRATIONS

Current Site Identification	Previous Site Identification	Site Description	Contaminants and Contaminated Media	Background Concentrations	Migration Pathway	Exposed Population	Target Risk Levels (1)
SS03	**Source 7:** Waste Accumulation Area No. 5	Area used for waste storage during the 1960s and 1970s. Spills and leaks occurred at the site.	Samples have not been collected for Source 7.				
SD07	**Source 8:** Runway Oiling	Waste fluids were used on runway for dust control. Waste fluids consisted of oils, solvents, ethyl–ene glycol, and other shop residues.	<u>Surface Soil</u> 4,4'–DDT 2.2J–25J ug/kg 4,4–DDD ND–1.8J ug/kg benzene ND–1J ug/kg 1,2–DCA ND–3J ug/kg Carbon disulfide ND–16 ug/kg SVOCs ND Samples were not analyzed for TAL metals.				
LF05	**Source 10:** Landfill No. 2	An approx. 1–acre area used from 1977 to present to dispose of installation wastes, such as in–cinerator ash, wood, metal, oil filters, empty drums, fuel absorbents, oil spill residue, paint resid–uals, and construc–tion debris.	<u>Surface Soil</u> 4,4'–DDE 1.2J–1.5J ug/kg 4,4'–DDD 5.6J–6.5J ug/kg 4,4'–DDT 49J–65J ug/kg PCE ND–0.8J ug/kg SVOCs ND Inorganics: aluminum 23700–26600 mg/kg arsenic 8.3–9.7 mg/kg barium 162–192 mg/kg beryllium 1J–1.1J mg/kg cadmium ND–0.96J mg/kg calcium 9090–10100 mg/kg chromium 17.1–27.8 mg/kg cobalt 14.5–15.6 mg/kg copper 25–35.6 mg/kg iron 34300–38500 mg/kg				

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TABLE 2.3−2 (continued)
INDIAN MOUNTAIN LRRS CONCEPTUAL SITE MODEL SUMMARY
LOWER CAMP
BACKGROUND CONTAMINANT CONCENTRATIONS

Current Site Identification	Previous Site Identification	Site Description	Contaminants and Contaminated Media			Background Concentrations	Migration Pathway	Exposed Population	Target Risk Levels (1)
			lead	11.2−11.9	mg/kg				
			magnesium	9620−9870	mg/kg				
			manganese	619−696	mg/kg				
			nickel	17−21.5	mg/kg				
			potassium	554J−618J	mg/kg				
			sodium	ND−555J	mg/kg				
			vanadium	83.8−94.6	mg/kg				
			zinc	75.2−97.3	mg/kg				
			Subsurface Soil						
			4,4'−DDE	1.3J−1.8J	ug/kg				
			4,4'−DDD	5.4J−19J	ug/kg				
			4,4'−DDT	12J−44J	ug/kg				
			benzene	ND−0.3J	ug/kg				
			toluene	ND−65	ug/kg				
			ethylbenzene	ND−0.4J	ug/kg				
			xylenes	ND−3J	ug/kg				
			PCE	ND−1J	ug/kg				
			carbon disulfide	ND−0.3J	ug/kg				
			SVOCs	ND					
			Inorganics:						
			aluminum	25000−27200	mg/kg				
			arsenic	8.5−8.7	mg/kg				
			barium	156−189	mg/kg				
			beryllium	1.1J−1.2J	mg/kg				
			cadmium	0.53J−0.87J	mg/kg				
			calcium	8870−12800	mg/kg				
			chromium	19.2−22.1	mg/kg				
			cobalt	15.9−17.8	mg/kg				
			copper	30.7−41.2	mg/kg				
			iron	37600−43600	mg/kg				
			lead	7.9−15.2	mg/kg				
			magnesium	9770−12300	mg/kg				
			manganese	704−790	mg/kg				
			nickel	18.8−20.9	mg/kg				
			potassium	587J−634J	mg/kg				

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TABLE 2.3–2 (continued)
INDIAN MOUNTAIN LRRS CONCEPTUAL SITE MODEL SUMMARY
LOWER CAMP
BACKGROUND CONTAMINANT CONCENTRATIONS

Current Site Identification	Previous Site Identification	Site Description	Contaminants and Contaminated Media			Background Concentrations	Migration Pathway	Exposed Population	Target Risk Levels (1)
			sodium	487J–599J	mg/kg				
			vanadium	92.8–105	mg/kg				
			zinc	67.7–109	mg/kg				
	Water Supply Well Note: The well is not a source area.	The drinking water collection system that consists of a 3–ft diameter CMP installed vertically below grade to intercept ground–water.	Groundwater						
			Pest./PCBs	ND					
			VOCs	ND					
			SVOCs	ND					
			Inorganics:						
			calcium	4970J	ug/l				
			copper	3.2J	ug/l				
			iron	50.2J	ug/l				
			magnesium	832J	ug/l				
			sodium	1150J	ug/l				
			zinc	16.1J	ug/l				

(1) Target risk levels are based on the concentrations corresponding to a carcinogenic risk of 1.0E–06 (1x10–06) and a noncarcinogenic hazard quotient of 1.
C = CarcinogenIndicates contaminant concentrations that were detected above the target risk level.
NC = Noncarcinogenic target risk concentration
Analytical results from the September 1992 Site Investigation conducted by Woodward–Clyde were validated and are summarized in this table.
Analytical results from other past field investigations have not been validated and are not included in this table.
Applicable or Relevant and Appropriate Requirements (ARARs) for the detected chemicals are summarized in Section 2.5.
All contaminant concentrations detected in the samples collected during the 1992 SI are below ARARs.
Indicates contaminant concentrations that were detected above the target risk level.

AST = Aboveground Storage Tank
BHC = hexachlorocyclohexane
CMP = Corrugated Metal Pipe
DCA = 1,2–dichloroethane
DDD = dichlorodiphenyldichloroethane
DDE = dichlorodiphenyldichloroethylene
DDT = dichlorodiphenyltrichlorethane
GW = groundwater
J= estimated concentration
PCE = tetrachloroethene
Pest./PCBs = pesticides and polychlorinated biphenyls
SW = surface water
SVOCs = Semivolatile Organic Compounds
TAL = Target Analyte List
VOCs = Volatile Organic Compounds

Source: Air Force 1993b

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Indian Mountain LRRS were used for dust control on the road until 1984. Dust control activities were probably conducted beginning in the 1950s. The "Runway" portion of SD07 is described in the CSM for Lower Camp.

- OT08 (Source 11: White Alice Site) is the former location of WACS. The WACS site was demolished, and the debris was burned and buried onsite in the mid-1980s. WACS operated from 1958 to 1979. Wastes generated at the site may have included POL and PCBs.

- SS10 (Source 3: Waste accumulation area no. 6) was the main accumulation area from the 1950s to the 1970s. The area encompassed most of the upper bench and portions of the lower bench. The area was cleaned up and graded during the period 1978 to 1980. Wastes included POLs, small quantities of shop wastes, and other liquids. SS10 also includes spill/leak nos. 2, 5, 6, 7, 9, and 10, which consist of fuel leaks and spills that occurred during the 1970s.

2.3.1.2 Contaminant Identification

Surface soil samples were collected at SS10 and SD07 during the SI conducted by W-C in 1992. Arochlor-1260 was detected in soil samples collected at SS10 and SD07. PCE, BTEX, and chlorobenzene were also detected in the surface soil samples collected along the road at SD07. Samples have not been collected at SD01 and OT08. Potential contaminants at Upper Camp include PCBs, pesticides, and fuel-related contaminants. Sample results from the 1992 SI are summarized in Table 2.3-1. No samples were collected from background locations at Upper Camp during the SI.

2.3.1.3 Potential Migration Pathways

Release Mechanisms. Contaminants may have been released to the environment through spills of fuels and PCB-contaminated oil to the land surface. Drums of liquid waste stored at the accumulation area may also have leaked onto the land surface. Additionally, there have been intentional releases of liquid wastes through the practice of oiling the roads for dust control. These spills, leaks, and intentional releases are the primary release mechanisms to environmental media. Secondary release mechanisms include contaminants present at the surface, such as oil releases, that can be transported to other surface soil, surface water, and sediment areas through erosion and runoff. Contaminants can also be carried into the subsurface by infiltration and percolation. Contaminants can be transported to other areas of surface and subsurface soil by entrainment in soil, infiltration and percolation, and release to the surface at springs and seeps. Contaminants that infiltrate and percolate to groundwater can be transported downgradient with the groundwater flow. Liquid contaminants or contaminated groundwater are expected to flow through weathered bedrock and fill away from the summit of Indian Mountain. Contaminants may be discharged to the surface at seeps or may flow further downhill through colluvial deposits where they can discharge at streams along the flanks of the mountain (Figure 2.3-1), or at the old water intake structure. Although the WACS site is not shown on Figure 2.3-1, conditions similar to the portion of Upper Camp shown on Figure 2.3-1 are also expected to be encountered at the WACS site.

Additional secondary release mechanisms include those where contaminants that are transported to surface or subsurface soil can be further released by erosion and runoff, infiltration and percolation, volatilization, and fugitive dust emission. Primary

and secondary release mechanisms for contaminants at Upper Camp are illustrated on Figure 2.3-1.

Transport Media. Depending on the nature of the source and the release mechanism, several transport pathways are possible. These transport pathways and the media within which they occur are illustrated in Figure 2.3-1. Generally, the transport media include air, surface water, groundwater, soil, and sediment. Biota such as plants and prey species may take up contaminants from debris, sediment, surface water, air, and soil. Biota that have been contaminated can also serve as transport media if they are consumed by humans or terrestrial or aquatic organisms.

Exposure Routes. Routes of exposure to contaminants in potentially contaminated media include inhalation, ingestion, dermal contact, and plant uptake. The exposure routes applicable to different transport media are illustrated in Figure 2.3-1 as arrows pointing in the direction of contaminant transport. If concentrations are significant, surface debris, sediment, soil, and surface water can result in human and ecological exposure to contaminants by inhalation, ingestion, or dermal contact. Human or ecological exposure to contamination in biota may occur by ingestion.

2.3.1.4 Receptors

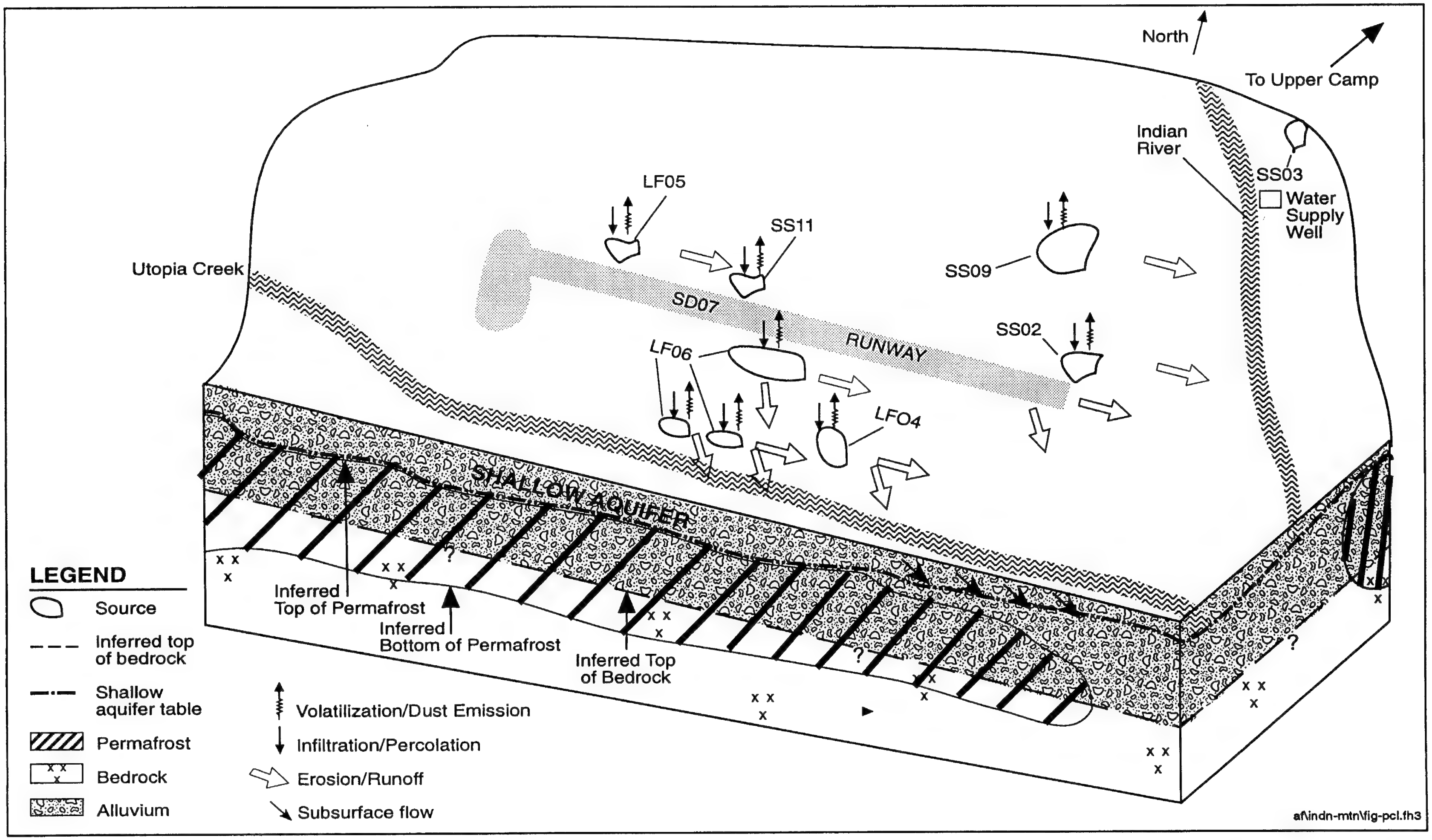
Human exposures to contaminated media can occur to contractor personnel maintaining the facilities at Indian Mountain LRRS. Because groundwater provides the principal domestic water supply for the station, all residents may have some exposure to potential contaminants in the drinking water system. However, the current domestic water supply at Indian Mountain LRRS is unlikely to be affected by contamination from Upper Camp. Human exposure is also possible through consumption of contaminated biota such as vegetation or game fish.

Ecological receptors include aquatic and terrestrial biota. Aquatic biota may contact surface water or sediment that has been affected by runoff or groundwater containing contaminants. Terrestrial biota, like humans, can be exposed to surface debris, sediment, surface water, and air. Either aquatic or terrestrial biota might consume contaminated biota lower in the food chain.

2.3.1.5 Contaminant Concentrations at Receptors

To provide points of comparison for contaminant concentrations detected in samples collected during the 1992 SI, preliminary remediation goals (PRGs) have been developed. The PRGs are based on a conservative, reasonable maximum exposure to industrial workers, such as civilian contractor personnel. The PRGs have been developed using formulas and assumptions outlined in EPA 1991. The PRGs developed for comparison to contaminant concentrations are summarized on Table 2.3-1 and are derived from the following exposure assumptions:

• Soil/sediment ingestion rate	50 milligrams (mg)/day
• Groundwater ingestion rate	2 liters (l)/day
• Groundwater inhalation rate	15 cubic meters (m^3)/day
• Volatilization factor	0.5 l/m^3
• Body weight	70 kilograms (kg)
• Exposure frequency (soil)	180 days/year
• Exposure frequency (groundwater)	350 days/year
• Exposure duration	20 years



INDIAN MOUNTAIN LONG RANGE RADAR STATION

SCHEMATIC CONCEPTUAL SITE MODEL UPPER CAMP

PROJ. MGR.	ACAD FILE NO.	FIGURE NO.	
L.SCHUTTER	2_3-1	2.3-1	
DRAWN BY	PROJ. NO.		DATE
HUNTER	05-G-46200		6/3/94

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- Averaging time (carcinogenic) 70 years
- Averaging time (noncarcinogenic) 20 years

These exposure assumptions were developed to include both the current exposure scenario and, based on current information, the expected future exposure scenario. The future exposure scenario assumes continued use of the site to support long-range radar activities with essentially the same staffing levels as at present. The assumed exposure scenarios include use of groundwater for domestic water supply by contractor personnel residing at the site full-time (350 days per year); incidental ingestion of soils by personnel performing soil excavation and similar activities for a maximum of 180 days per year (assuming that snow cover and adverse weather conditions make such activities unlikely to be performed routinely for one-half the year); and a maximum exposure duration of 20 years for a single individual (recognizing that some contractor personnel have been at the site for several years). For purposes of calculating these PRGs, it has also been assumed that exposure to soils due to dermal contact and inhalation of dust and volatiles from soils are negligible compared with direct ingestion of contaminated soil, because of the limited excavation work performed and the fact that the site has substantial snow cover during much of the year.

PRGs listed in Table 2.3-1 represent the target risk level based on the concentrations corresponding to a carcinogenic risk of $1x10^{-6}$ and a noncarcinogenic hazard quotient of 1. All contaminant concentrations detected in samples collected during the 1992 SI are below the target levels for carcinogenic and noncarcinogenic risk. All contaminants detected in soil samples were also below ARARs identified in Section 2.5. Background data have not been collected at Upper Camp. Background samples of environmental media will be collected during the 1994 RI and analyzed for the same parameters as samples from sources. Background sample concentrations will be compared to source sample concentrations, as appropriate.

Groundwater and surface water samples were not collected at sources in Upper Camp for analysis during the 1992 SI. An attempt to collect representative surface water samples will be made during the 1994 RI, as well as to collect additional soil samples from the three source areas associated with Upper Camp. If necessary, additional media-specific PRGs will be developed using the exposure assumptions described above for each additional contaminant detected during the RI. Carcinogenic target risk levels will also be evaluated for concentrations corresponding to $1x10^{-5}$ and $1x10^{-4}$ risks to support a no further action decision or remedial action, based on the results of the 1994 RI. The No Further Response Action Planned (NFRAP) decision criteria (Air Force 1993c) identify a cumulative carcinogenic baseline risk to an individual exceeding $1x10^{-4}$. Based on this exposure scenario, historical information, and environmental setting, all contaminants previously detected and concentration ranges anticipated to be encountered during the RI are expected to be well below the $1x10^{-4}$ risk.

2.3.2 Lower Camp Conceptual Site Model

The following sections contain information used to prepare the conceptual site model specifically for Lower Camp.

2.3.2.1 Lower Camp Description

Lower Camp is located between the confluence of Indian River and Utopia Creek. The land surface slopes steeply upward toward Indian Mountain and moderately downward toward the west and south. A 10-mile road connects Lower Camp to Upper Camp. Lower Camp is the location of the support and residential facilities for the station. Eight contaminant sources have been identified at Lower Camp. These sources are described below. Detailed descriptions of these sources are included in Section 2.2. Source locations are shown in Figure 2.2-1.

- SS02 (Source 5: Waste accumulation area no. 1) was used from the 1950s to the mid-1980s to store drummed wastes before offsite disposal.

- SS03 (Source 7: Waste accumulation area no. 5) was used as a waste storage area during the 1960s and 1970s. It is located on the north side of the road to Upper Camp. Spills and leaks occurred in the area, and oil drums were removed in 1980.

- LF04 (Source 4: Landfill no. 1) was used from 1953 to 1977 to dispose of garbage, wood, and small quantities of shop wastes.

- LF05 (Source 10: Landfill no. 2) is the current landfill location. It has been in use since 1977.

- LF06 (Source 2: Waste accumulation area no. 4 and landfill nos. 3 and 4) is located south of the runway. Drums possibly containing liquid wastes were stored or buried. Waste accumulation area no. 4 was used for drums containing fuel or waste in the 1950s and 1960s. Landfill no. 3 was used to dispose of debris associated with a cleanup of Lower Camp during the period 1978 to 1980. Landfill No. 4 was used in the 1970s to bury drums that had been scattered along the runway.

- SD07 (Source 8: Runway/Road Oiling) consists of the dust control activities on the runway using waste oil accumulated at Indian Mountain LRRS from approximately the 1950s to 1984. The "Road" portion of SD07 was described in the CSM for Upper Camp.

- SS09 (Source 6: Waste accumulation area no. 3) was used to store waste oil and other liquids in aboveground storage tanks from the 1950s to 1984. SS09 also includes spill/leak nos. 4 and 11, which consist of POL releases in the area.

- SS11 (Source 1: Spill/leak nos. 1, 3, and 8) is associated with tanks adjacent to the north side of the runway.

2.3.2.2 Contaminant Identification

Soil samples were collected at LF06, LF04, SS02, SS09, SD07, and LF05 during the 1992 SI. Samples have not been collected at SS03 or SS11. The pesticides 4,4'-DDE, 4,4'-DDD, and 4,4'-DDT were routinely detected in the soil samples from all of the sources sampled. PCE was detected in soil samples from three of the six sources sampled. Fuel-related contaminants were detected in samples from four of the six sampled locations. Arsenic was detected above action levels in the samples from all of the sources sampled, with the exception of SD07, where samples were not analyzed for TAL metals. The arsenic concentrations above action levels are

described in Section 2.3.2.5. Sample results from the 1992 SI are summarized on Table 2.3-2.

2.3.2.3 Potential Migration Pathways

Release Mechanisms. Contaminants may have been released to the environment through spills of fuels and other liquid wastes to the land surface. Drums of liquid waste stored at the accumulation areas may also have leaked to the land surface. Surface and subsurface debris, including large numbers of drums, are present in the landfills. Releases from the sources to environmental media constitute primary release mechanisms.

Secondary release mechanisms include contaminants present at the surface, such as fuel spills, surface landfill debris, and material released from drums, that can be transported to other surface soil or sediment areas by erosion and runoff. Contaminants from sources can also be carried into the subsurface by infiltration and percolation. Subsurface debris, subsurface leaks, and residual material contained in surface soil can be transported to other areas of surface and subsurface soil by entrainment in soil, infiltration and percolation, and release to the surface water in Indian River and Utopia Creek.

Liquid contaminants or contaminated groundwater are expected to flow along the permafrost surface or within the active zone above the permafrost table toward Indian River or Utopia Creek (Figure 2.3-2). Groundwater encountered in soil borings drilled beneath the permafrost unit is also expected to flow toward Indian River and Utopia Creek. Based on information from soil borings and test pits, permafrost is not present beneath the surface water bodies, and the potentiometric surface is above the elevation of the river and creek. This information indicates that groundwater in the vicinity of the river and creek may be in hydraulic connection with the surface water, and groundwater may flow downstream in conjunction with the surface water as subflow within the streambed alluvium. In this case, the river and creek would be expected to act as hydraulic barriers preventing the flow of groundwater across the river or stream. However, the potential exists for contaminants in groundwater to migrate to surface water. The surface water and groundwater flow directions are illustrated on Figure 2.3-2.

Additional secondary release mechanisms include contaminants that infiltrate and percolate down through the soil, and can enter groundwater and flow downgradient with the groundwater flow. Contaminants that are transported to surface or subsurface soil can be further released by erosion and runoff, infiltration and percolation, volatilization, and fugitive dust emissions. Primary and secondary release mechanisms are illustrated in Figure 2.3-2 as arrows pointing in the direction of contaminant transport.

Transport Media. Depending on the nature of the source and the release mechanism, several transport pathways are possible. Generally, the transport media include air, surface water, groundwater, soil, and sediment. Biota such as plants and prey species may take up contaminants from debris, sediment, surface water, air, and soil. Biota that have been contaminated can themselves serve as transport media if they are consumed by humans or terrestrial or aquatic organisms. Transport pathways and the media in which they occur are illustrated in Figure 2.3-2.

Exposure Routes. Routes of exposure to contaminants in potentially contaminated media include inhalation, ingestion, dermal contact, and plant uptake. Surface debris, sediment, soil, and surface water can result in human and ecological exposure to contaminants by inhalation, ingestion, or dermal contact. Groundwater can result in human exposure to contaminants by inhalation, ingestion, and dermal contact. Human and ecological exposure to contamination in biota may occur by ingestion. The exposure routes applicable to transport media are illustrated in Figure 2.3-2.

2.3.2.4 Receptors

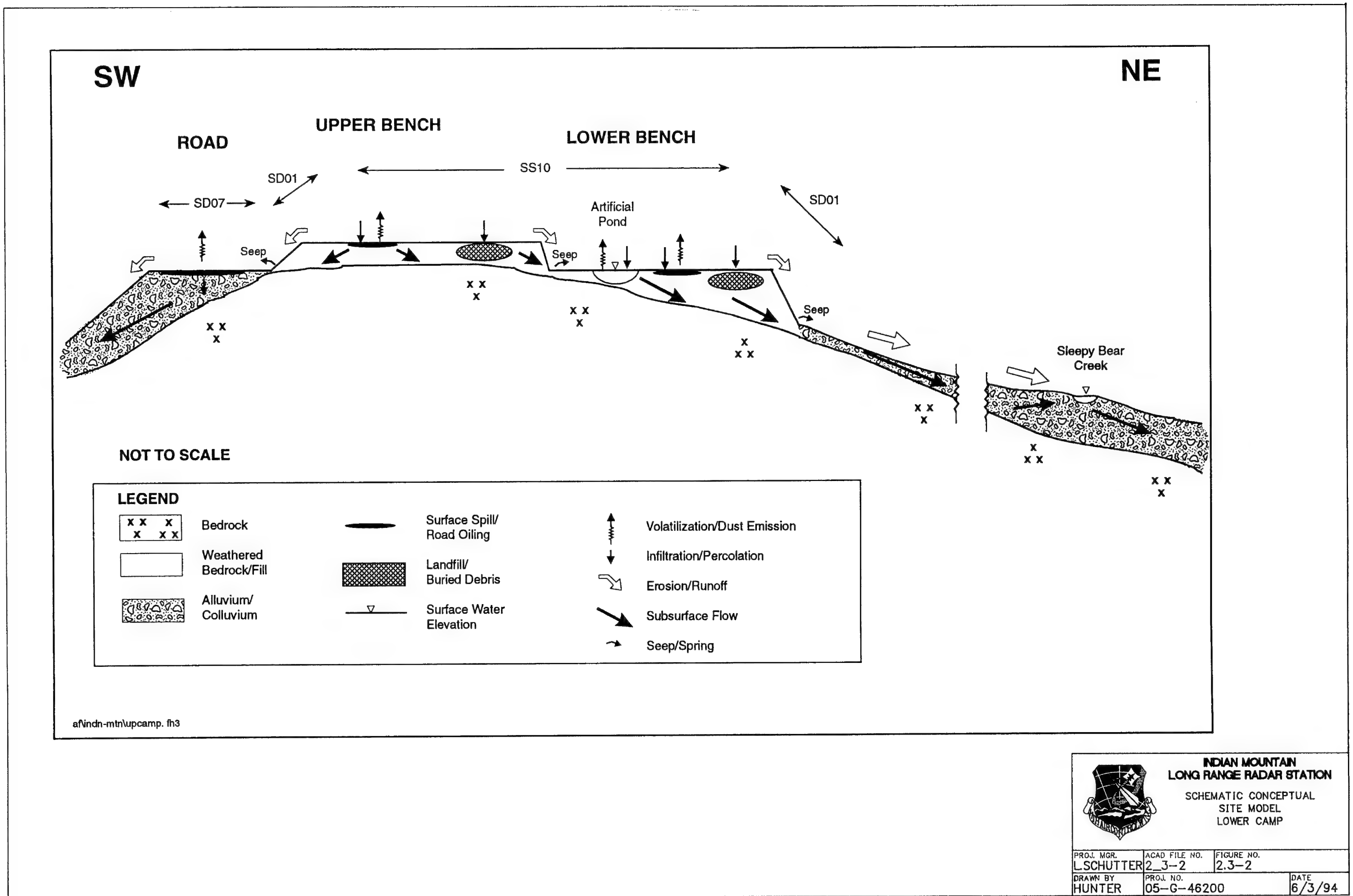
Human exposures to contaminated media can occur to contractor personnel who maintain the facilities at Indian Mountain LRRS. Because groundwater provides the principal domestic water supply for residents at Lower Camp, residents and visitors may have some exposure to potential contaminants in groundwater from the gallery drinking water system.

Ecological receptors include aquatic and terrestrial biota. Aquatic biota may contact surface water or sediment that has been affected by runoff or groundwater containing contaminants. Terrestrial biota, like humans, can be exposed to surface debris, sediment, surface water, and air. Either aquatic or terrestrial biota might consume contaminated biota lower in the food chain.

2.3.2.5 Contaminant Concentrations at Receptors

As discussed in the CSM for Upper Camp, PRGs have been developed using conservative exposure assumptions for use as points of comparison in current and future exposure scenarios. All contaminants detected in environmental media collected during the 1992 SI at the sources identified at Lower Camp were below the target risk levels for carcinogenic and noncarcinogenic risk, with the exception of arsenic in the soil samples collected from the six sources. However, these arsenic concentrations are slightly above the target level concentrations for a carcinogenic risk of 1×10^{-6}, approximately an order of magnitude below the target level concentrations for a carcinogenic risk of 1×10^{-5}, and approximately two orders of magnitude below the target level concentrations for a carcinogenic risk of 1×10^{-4}. All contaminants detected in soil samples were also below ARARs identified in Section 2.5. Background groundwater and surface water samples have not been collected at Lower Camp. Additional background samples of environmental media will be collected during the 1994 RI and analyzed for the same parameters as samples from sources. Background sample concentrations will be compared to source sample concentrations, as appropriate.

Groundwater and surface water samples were not collected at sources for analysis during the 1992 SI at Lower Camp. An attempt will be made to collect representative groundwater and surface water samples during the 1994 RI, as well as additional soil samples from five of the six source areas associated with Lower Camp. If necessary, additional media-specific PRGs will be developed using the exposure assumptions described in the CSM for Upper Camp for each additional contaminant detected during the RI. Carcinogenic target risk levels will also be evaluated for concentrations corresponding to 1×10^{-5} and 1×10^{-4} risks to support a no further action decision or remedial action, based on the results of the 1994 RI. The NFRAP decision criteria (Air Force 1993c) identify a cumulative carcinogenic baseline risk to an individual exceeding 1×10^{-4}. Based on this exposure scenario, historical information, and environmental setting, all contaminants previously



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detected and contaminant concentration ranges anticipated to be encountered during the RI are expected to be well below the $1x10^{-4}$ risk.

2.4 REMEDIAL ACTION

No previous remedial actions have been conducted at Indian Mountain LRRS. In 1986, most of the old Upper and Lower Camp facilities and WACS were demolished. No environmental sampling was conducted during demolition activities.

2.4.1 Preliminary Remedial Action Objectives

To conduct a remedial action, a set of remedial action objectives should be identified to address the site specific characteristics that will influence the decision-making process when selecting feasible alternatives. Remedial action objectives are based on available media-specific information on contaminants of concern, exposure routes, and an acceptable contaminant level or range of levels for each exposure route. Remedial action objectives can be used to develop the range of alternatives. Because no risk management evaluation has been performed, no potential contaminants of concern have been formally identified. Due to limited Level II analytical data presently available, remedial action objectives have not been developed for groundwater, surface water, sediment, surface soil, or subsurface soil at Indian Mountain LRRS. Additional data collected during the 1994 RI/FS will be used to develop the remedial action objectives.

2.4.2 Preliminary Remedial Alternatives

The goal of selecting preliminary alternatives is to identify potential technologies that may be applicable for meeting the preliminary remedial action objectives. A more detailed screening process to evaluate the most applicable technologies will be conducted after the preliminary remedial action objectives have been identified and additional information is collected. Due to the remote location, many preliminary alternatives are eliminated by specific considerations used in screening. Two considerations used to identify preliminary alternatives include (1) mobility (for transport, construction, and set-up time); and (2) practicality (in terms of resource and operational requirements). The six primary preliminary remedial alternatives identified for Indian Mountain LRRS include:

- no action
- natural attenuation
- long term monitoring
- removal of source areas
  - excavation of contaminated soils; and
  - free product removal
- containment actions
  - encapsulation, and
  - immobilization/fixation; and
- treatment actions
  - separation,
  - thermal destruction, and
  - chemical/biological treatment.

Remedial alternatives identified for Indian Mountain LRRS will be evaluated concurrently with review of the 1994 RI/FS analytical data. Remedial alternatives will be evaluated in regard to each alternative's ability to meet to remedial action objectives developed for each medium identified for remedial action.

2.5 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Section 121(d) of CERCLA/SARA requires that site cleanups attain ARARs. Any regulation, standard, requirement, criterion, or limitation under any federal or state law may be either applicable or relevant and appropriate to a remedial action. Applicable requirements include cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a pollutant, contamination, remedial action, location, or other situation at a site. An applicable requirement is one that would legally apply to the response action if that action was not taken pursuant to Section 104 or Section 106 of CERCLA. Relevant and appropriate requirements are cleanup standards, standards of control, and other substantive environmental limitations that are not legally applicable to the remedial action; however, they address the circumstance sufficiently similar to conditions at the site, and their use is well suited to the remedial action.

If it is determined that remedial actions will be required at Indian Mountain LRRS following completion of the RI/FS, each action must be evaluated to determine whether it meets federal laws, standards, requirements, regulations, criteria, or limitations that constitute ARARs. This task also includes an evaluation of state requirements. EPA considers a state requirement to be promulgated if it is legally enforceable and of general applicability. Additionally, only those standards that are identified by the state in a timely manner and are more stringent than federal requirements may be relevant and appropriate.

The ARARs identified in this preliminary evaluation are based on information pertaining to historical use of the station, previous investigations, and environmental setting. If the 1994 RI/FS effort provides new information regarding contamination at the station, additional ARARs may need to be evaluated. For example, if the 1994 effort identifies a chemical not found in previous investigations, chemical-specific and possibly action-specific ARARs pertaining to that chemical would be added to the ARARs evaluation. If all situations encountered in the RI have been addressed in this preliminary ARARs evaluation and it is sufficiently comprehensive, the information provided in the following sections will be used to support preparation of decision documents.

2.5.1 Chemical, Action, and Location-Specific ARARs

<u>Chemical-Specific ARARs</u>. The majority of the chemical-specific ARARs are health or risk-based numerical concentrations or methodologies that, when applied to site-specific conditions, result in the derivation of numerical concentrations. These concentrations establish the acceptable quantity of a chemical that may be found in or discharged to the ambient environment. If a chemical has more than one requirement that is an ARAR, the most stringent requirement is usually applied to a given situation.

Generally, chemical-specific requirements are set for a single chemical or closely-related group of chemicals. These requirements typically do not consider the mixtures of chemicals that may be found at DOD sites. Because of the site-specific

conditions, cleanup standards set for levels of a single contaminant may not adequately protect human health or the environment. If chemical-specific ARARs are determined not to be protective or are not available for contaminants at the site, other criteria or guidelines to be considered (TBC) may be applied to site contaminants, as discussed in Section 2.5.2. Tables 2.5-1 and 2.5-2 list the chemical-specific ARARs identified for chemicals detected in environmental media sampled by W-C in September 1992 (Air Force 1993b). Chemical-specific ARARs identified for site contaminants will provide action levels, below which further action will not be required. Tables 2.5-1 and 2.5-2 contain chemical-specific ARARs for both human health and ecological receptors.

Action-Specific ARARs. Action-specific ARARs are usually technology or activity-based requirements or limitations on action taken with respect to contaminants of concern. These requirements are triggered by the particular remedial activities that are selected to accomplish a remedy. Action-specific requirements do not determine the remedial action; however, they indicate how a selected alternative will be accomplished. Tables 2.5-3 and 2.5-4 summarize potential action-specific ARARs for Indian Mountain LRRS. These tables provide a comprehensive listing of action-specific ARARs that may apply to the site if remedial action is warranted. If no further action is warranted, an evaluation will be made to determine if any of these requirements are necessary to support preparation of a No Further Action Document.

Location-Specific ARARs. The location of a site is fundamental in determining its impact on human health and the environment. Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they are in specific or sensitive locations. Examples of special locations are floodplains, wetlands, historic places, and sensitive eco-systems or habitats. Table 2.5-5 summarizes the location-specific ARARs for Indian Mountain LRRS. This list provides a preliminary evaluation of location-specific requirements that may apply to the site if remedial action is warranted.

2.5.2 Other Criteria or Guidelines To Be Considered

Regulations, criteria, advisories, guidance, and proposed standards that are not legally binding may provide useful information or recommended procedures. This information does not provide potential ARARs; however, it may be evaluated in addition to ARARs to set protective action target levels. Chemical-specific concentrations developed from health advisories and reference doses are used to develop other TBC criteria or guidelines in the absence of ARARs or when ARARs are not sufficiently protective. More stringent cleanup goals may be set using exposure scenarios specific to the site. Table 2.5-6 summarizes the TBC criteria and guidelines that may be used to evaluate the results of the RI. Because ecological ARARs are not available, Tables 2.5-1 and 2.5-2 include chemical-specific TBCs that have been compiled for ecological health.

As previously stated, TBC criteria and guidelines may be used in the absence of ARARs. ARARs are not available for the majority of the contaminants previously detected in environmental media. PRGs are defined as acceptable exposure levels that are protective of human health and the environment and comply with ARARs. PRGs reflect concentrations of contaminants in environmental media that are unlikely to be associated with adverse health effects under defined, usually conservative, exposure scenarios. PRGs developed for the Indian Mountain LRRS RI were discussed in detail in Section 2.3. PRGs have been calculated for the

TABLE 2.5-1
POTENTIAL FEDERAL CHEMICAL-SPECIFIC ARARS AND TBCS FOR ANALYTES DETECTED DURING THE 1992 SITE INVESTIGATION INDIAN MOUNTAIN LONG RANGE RADAR STATION

	HUMAN HEALTH		ECOLOGICAL	
	Groundwater (µg/l)		Surface Water (µg/l)	Sediment (mg/kg)
Analyte (1)	MCLs and Drinking Water Standards (2)	SMCL (2)	Ambient Water Quality Criteria (3)	NOAA (4)
Pesticides/PCBs:				
4-4'-DDE	–	–	–	0.016
4-4'-DDD	–	–	–	0.02
4-4'-DDT	–	–	0.001/1.1	0.007
Aroclor 1260	0.5	–	–	0.4
Volatile Organics:				
1,2-Dichloroethane	5	–	20,000(a)/ 118,000(a)	–
Tetrachloroethane	5	–	840(a)/5,280(a)	–
Chlorobenzene	100	–	50(b)/250(b)	–
Benzene	5	–	–/5,300(a)	–
Toluene	1,000	–	–/17,500(a)	–
Ethylbenzene	700	–	–/32,000(a)	–
Total xylenes	10,000	–	–	–
Semivolatile Organics:				
Phenanthrene	–	–	6.3(c)/30(c)	13.8
Fluoranthene	–	–	–/3980(a)	–
Phenol	–	–	2560(a)/10,200(a)	–
Inorganics:				
Aluminum	–	50	–	–
Antimony	6	–	30/88(c)	25
Arsenic	50	–	190(d)/360(d)	85
Barium	2,000	–	–	–
Beryllium	4	–	5.3(a)/130(a)	–
Cadmium	5	–	1.1/3.9(a)	9
Chromium	50	–	210(e)/1700	145
Copper	1,300	1,000	12(e)/18(e)	390
Iron	–	300	1,000/–	–
Lead	15	–	3.2(e)/82(e)	110
Manganese	–	50	–	–
Mercury	2	–	0.012/2.4	1.3
Nickel	100	–	160(e)/1,400(e)	50
Selenium	50	–	35/260	–
Silver	50	10	1.2/4.1(e)	2.2
Zinc	5,000	5,000	110(e)/120(e)	270

Note: Only analytes with ARARs or TBCs are shown on this table.

µg/l = micrograms per liter
mg/kg = milligrams per kilogram
MCLs = maximum contaminant levels
SMCLs = secondary maximum contaminant levels
ARARs = Applicable or Relevent and Appropriate Requirements
TBCs = Other Criteria To Be Considered

(1) Chemical detected in soil and water samples collected by Woodward Clyde Consultants during the Site Investigation conducted in September 1992, (U.S. Air Force 1993b).
(2) MCLs and drinking water standards extracted from 40 CFR Part 141; SMCLs are extracted from 40 CFR Part 143.
(3) U.S. EPA 1988, EPA 440/5-88-001; concentrations are for water and fish ingestion, freshwater chronic/acute.
(4) National Oceanic and Atmospheric Administration (NOAA) NOS/OMa52. The potential for biological effects of sediment-sorbed contaminants tested in the National Status and Trends Program. Long, ER and Morgan, L.G., 1991.

(a) Lowest Observed Effect Level (LOEL) derived from Water Quality Criteria Summary, USEPA Office of Science and Technology, May 1, 1991 (poster).
(b) Lowest Effect Concentration (LEC), IRIS 45 FR 79318, November 28, 1980.
(c) proposed criteria
(d) Concentrations listed are for Arsenic III, which is the most conservative concentration available.
(e) Hardness dependent.

TABLE 2.5-2
POTENTIAL STATE CHEMICAL-SPECIFIC ARARS AND TBCS FOR ANALYTES DETECTED DURING THE 1992 SITE INVESTIGATION INDIAN MOUNTAIN LONG RANGE RADAR STATION

	HUMAN HEALTH			ECOLOGICAL
	Groundwater (µg/l)	Soil (mg/kg)		Surface Water (µg/l)
Analyte (1)	Alaska Drinking Water Standards (2)	Alaska UST (3)	Alaska Non-UST (4)	Alaska Water Quality Standards (5)
Volatile Organics:				
Benzene	-	0.1	0.1	-
Total BTEX	-	10	10	10
Gasoline components	-	50	50	Free of oils
Diesel components	-	100	100	Free of oils
Residual components	-	2000	-	-
Total hydrocarbons	-	-	-	15
Inorganics:				
Arsenic	50	-	-	-
Barium	1,000	-	-	-
Cadmium	10	-	-	-
Chromium	50	-	-	-
Copper	1,000	-	-	-
Iron	300	-	-	-
Lead	50	-	-	-
Manganese	50	-	-	-
Mercury	2	-	-	-
Selenium	10	-	-	-
Silver	50	-	-	-
Sodium	250,000	-	-	-
Zinc	5,000	-	-	-

Note: Only analytes with ARARs or TBCs are shown on this table.

µg/l = micrograms per liter
mg/kg = milligrams per kilogram
ARARs = Applicable or Relevent and Appropriate Requirements
TBCs = Other Criteria To Be Considered

(1) Chemical detected in soil and water samples collected by Woodward Clyde Consultants during the Site Investigation conducted in September 1992 (U.S. Air Force 1993b).
(2) 18 AAC 80
(3) 18 AAC78
(4) Alaska Department of Environmental Conservation, Interim Guidance for Non-UST Contaminated Soil Cleanup Levels, Guidance Number 001 Revision No. 1, July 17, 1991.
(5) 18 AAC 70

TABLE 2.5-3
Potential Action-Specific Federal ARARs
Indian Mountain Long Range Radar Station

ACT AND REGULATION	CITATION	DESCRIPTION	APPLICABILITY
Resource Conservation and Recovery Act (RCRA)	42 USC Section 6901-6987	Provides for regulations pertaining to solid/hazardous waste.	
Identification and Listing of Hazardous Waste	40 CFR 261	Defines solid wastes that are subject to regulation as hazardous waste.	Accumulation of hazardous waste during remedial action.
Standards Applicable to Generators of Hazardous Waste	40 CFR 262	Describes requirements for persons or facilities that generate hazardous waste.	Generation of hazardous waste during remedial action.
Standards Applicable to Transporters of Hazardous Waste	40 CFR 263	Provides requirements for persons or facilities transporting hazardous waste within the U.S.	Transport of waste offsite.
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	40 CFR 264	Describes requirements for persons or facilities treating, storing, and/or disposing of hazardous waste.	Treatment, storage, and/or disposal of hazardous wastes generated onsite during remedial action.
Standards for Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities	40 CFR 266	Provides requirements that apply to recyclable materials used in a manner constituting disposal or hazardous waste burned for energy recovery.	Recycling of certain types of previously used materials onsite.
Land Disposal Restrictions Program	40 CFR 268	Sets treatment standards for hazardous wastes based on the levels achievable by current technology.	Land disposal of hazardous waste onsite.
Clean Water Act	33 USC Section 1251-1376		
Criteria and Standards for the National Pollutant Discharge Elimination System	40 CFR 125	Provides discharge criteria, chemical standards, and other requirements for existing operations that may discharge pollutants into waters of the U.S.	Discharge to surface water features on and near site during remedial action.
Clean Air Act	42 USC 7401 et seq.		
National Emission Standards for Hazardous Air Pollutants	40 CFR 61	Provides emissions standards for hazardous air pollutants that affect human health.	Discharge of pollutants to air during remedial action; includes air stripping, incineration, and storage of petroleum products.
National Primary and Secondary Ambient Air Quality Standards	40 CFR 50	Provides standards for ambient air quality to protect public health and welfare.	Discharge of pollutants to air during remedial action.

TABLE 2.5-3
Potential Action-Specific Federal ARARs
Indian Mountain Long Range Radar Station

ACT AND REGULATION	CITATION	DESCRIPTION	APPLICABILITY
Safe Drinking Water Act	40 USC Section 300G		
EPA National Primary Drinking Water Regulations	40 CFR 141	Provides enforceable and recommended standards for public drinking water systems.	Impact to drinking water system during remedial activities.
EPA National Secondary Drinking Water Regulations	40 CFR 143	Provides recommended concentrations of certain chemicals that affect aesthetic quality of drinking water.	Impact to drinking water system during remedial activities.
Toxic Substances Control Act	15 USC 2601		
PCB Regulations	40 CFR 761	Provides standards for manufacturing, distribution, use, marking, storage, and disposal of PCBs and PCB items.	Requirements for incineration or landfilling of PCBs.
Federal Insecticide, Fungicide, and Rodenticide Act	40 CFR 165	Provides standards for disposal of pesticides and pesticide containers.	Pesticides used onsite may have contaminated soils.
Fish and Wildlife Coordination Act	16 USC 661	Requirements for discharges of pollutants into a body of water or wetlands, and for projects involving construction of dams, levees, impoundments, or stream relocation.	Remedial actions affecting Indian River, Utopia Creek, or other surface water bodies.

TABLE 2.5-4
Potential Action-Specific State ARARs
Indian Mountain Long Range Radar Station

ACT AND REGULATION	CITATION	DESCRIPTION
Alaska Hazardous Waste Management Regulations	18 AAC 62	Provides for adoption of federal requirements with additional criteria and standards.
Alaska Water Quality Standards	18 AAC 70	Sets standards for operations that cause or contribute to degradation of a water body.
Alaska Oil Pollution Control Law	AS 46.08	Provides for cleanup of oil discharges and also for the preparation of oil discharge prevention and contingency plans.
Alaska Air Quality Control Regulations	18 AAC 50	Provides standards for discharge of pollutants into air.
Alaska Wastewater Disposal Regulations	18 AAC 72	Provides restrictions for disposal of nondomestic wastewater into or onto land, surface water, or groundwater in Alaska.
Alaska Oil and Hazardous Substances Pollution Control Regulations	18 AAC 75	Provides restrictions for the use of oil, asphalt, bitumen, or residuary product of petroleum onto the lands of the state.
Alaska Underground Storage Tank Regulations	18 AAC 78	Provides standards for storage, remediation, and disposal of contaminanted soils.
Alaska Drinking Water Regulations	18 AAC 80	Provides standards for public drinking water systems.

TABLE 2.5-5
Potential Location-Specific Federal ARARs
Indian Mountain Long Range Radar Station

ACT AND REGULATION	CITATION	DESCRIPTION
Migratory Bird Treaty Act of 1972	16 USC Section 703-712	If migratory birds are present, provides protection of the majority of species of native birds in the U.S.
Endangered Species Act	16 USC 1531 et seq.	Provides for protection and conservation of designated species of fish, wildlife, and plants.
Wilderness Act	16 USC Section 1131 et seq.; 50 CFR 35.1 et seq.	Requires that federally-owned wilderness areas be administered in a manner that will leave the area unimpaired as wilderness and preserve its wilderness character.
Executive Order	EO 11988	Floodplain Management
Executive Order	EO 11990	Protection of Wetlands
Clean Water Act, Section 404	33 USC 1251 et seq., Section 404; 40 CFR 230 and 40 CFR 320 and 330	Restricts discharge of dredged or fill material into wetlands.
Archaeological and Historic Preservation Act	16 USC Section 469	Provides procedures for preservation of historical and archaeological resources when terrain is altered as a result of federal or federally-licensed construction activity.

Note: No potential state location-specific ARARs have been identified.

Table 2.5-6
Potential Other Criteria or Guidelines
To Be Considered (TBC) Requirements

FEDERAL
Agency for Toxic Substances and Disease Registry (ATSDR) Toxicity Profiles: Summaries of human health toxicity information by chemical
EPA Integrated Risk Information System (IRIS): An on-line database providing up-to-date information on reference doses and carcinogenic potency
EPA Health Effects Assessment Summary (HEAS) Tables: A tabular summary of reference doses, carcinogenic factors, and potency factors that is published quarterly
Drinking Water Health Advisories
Toxic Substances Control Act chemical advisories
EPA Water Quality Advisories
STATE
Alaska Department of Environmental Conservation, Guidance Manual for Underground Storage Tank Regulations, 18 AAC 78
Alaska Department of Environmental Conservation, Interim Guidance for Non-UST Contaminated Soil Cleanup Levels, Guidance Number 001 - Revision Number 1, July 17, 1991

contaminants detected in environmental media during the 1992 SI conducted by W-C. These PRGs were developed using both chemical-specific ARARs and TBC criteria and guidelines. When the data results from the RI are available, an evaluation may be necessary to determine any additional site-specific TBC criteria and guidelines. PRGs identified for site contaminants will provide action levels, below which further action will not be required.

2.5.3 Waiver of ARARs

CERCLA Section 121 provides that, under certain circumstances, an ARAR may be waived. The waivers apply only to attaining ARARs with respect to remedial actions onsite. Statutory requirements that state remedies must be protective of human health and the environment cannot be waived. A waiver must be invoked for each ARAR that will not be attained or is exceeded. The following waivers are described in CERCLA Section 121:

- Interim Measures may apply to sites at which a final site remedy is divided into several smaller actions that do not in themselves attain ARARs; however, the final remedy does attain ARARs.

- Greater Risk to Health and the Environment may be invoked for an ARAR that can only be met by using a remedial action that, because it meets ARARs, poses greater risks than a similar remedial alternative that does not meet ARARs.

- Technical Impracticability may apply to a site remedy when an unfavorable balance of engineering feasibility and reliability exists; cost is an important consideration.

- Equivalent Standard of Performance may be used in situations when an ARAR stipulates the use of a particular design or operating standard; however, better remedial results could be achieved using an alternative design or method of operation.

- Inconsistent Application of State Requirements is intended to prevent unjustified or unreasonable restrictions from being imposed on cleanup activities; the waiver is closely associated with the definition of "promulgated".

- Fund Balancing may be invoked when meeting an ARAR would entail such a high cost in relation of the added degree of protection or reduction of risk; remedy must still be protective of human health and the environment.

2.6 DATA NEEDS AND USES

The data needs to be satisfied by the Indian Mountain LRRS field investigation are determined by the overall and specific objectives and purposes of the Indian Mountain LRRS investigation. The general purposes include providing data to demonstrate compliance with ARARs and other appropriate risk-based action levels and to allow an RI/FS and/or an NFRAP decision be reached. The broad objectives of the IRP include the following:

- Identify and evaluate sources where contamination may be present on DOD property because of past hazardous waste disposal practices, spills, leaks, or other occurrence.

- Control the migration of hazardous contaminants.

- Control the human health hazards or hazards to the environment that may result from past DOD disposal operations.

Specific objectives of the Indian Mountain LRRS investigation have been developed through discussions between the Air Force and Jacobs in early 1994. These objectives have been refined during the planning process leading to this Work Plan and the companion SAP. The objectives of the Indian Mountain LRRS investigation, and decisions to be made, include the following:

- Collect data on background concentrations of potential contaminants in soil, surface water, groundwater, and sediment.

- Determine the extent, distribution, and concentration of soil contamination, if any. Determine whether soil contamination exceeds action levels and background values.

- Determine the extent, distribution, and concentration of groundwater contamination, if any. Determine whether groundwater contamination exceeds action levels and background values.

- Determine whether contamination of surface water and springs or seeps has occurred, and if so whether contaminated surface waters exceed action levels and background values.

- Determine whether contamination of sediment has occurred, and if so, whether contaminated sediment exceeds action levels and background values.

- Collect data needed for modeling of future contaminant transport through identified potential environmental pathways to support NFRAP or FS decisions.

2.6.1 Data Applications

Existing data for the Indian Mountain LRRS have been evaluated, and data gaps for geological, hydrogeological, background, and contaminant information have been identified. Those data gaps that are critical to the objectives and purposes of the investigation are addressed by the field investigation program. The data collected during the field effort will be applied to the following uses:

- Estimate the rate of surface water flow through the project area.

- Determine the degree of contamination of surface water, seeps and springs, and sediment.

- Determine the degree of contamination of surface soil, and soil in the permafrost active zone.

- Determine the degree of contamination of groundwater aquifers.

- Assess the hydraulic connections among the suprapermafrost groundwater, subpermafrost groundwater, and surface water bodies.

- Evaluate the hydraulic characteristics of groundwater aquifers and potential for infiltration of precipitation or contaminants.

- Identify the potential for migration of contaminated surface and subsurface soil to other environmental media.

- Assess the fate and transport of contaminants along transport pathways to human or ecological receptors.

- Estimate contaminant concentrations at points of exposure to receptors for comparison with ARARs.

In general, the data will be applied to determine the nature of contaminant sources, the potential for contaminant migration along various transport pathways, and contaminant concentrations at the ends of such pathways. The data will be used to refine and update the conceptual site models formulated in Section 2.3, which are intended to identify completed pathways, if any, from contaminant sources to receptors. The updated conceptual site models provide the information needed to support NFRAP decisions or FSs, if necessary.

2.6.2 Data Types

A wide variety of environmental media will be sampled, and data will be collected for the uses listed above. The data that will be collected include both physical parameters and chemical constituents, as well as spatial measurements of sampling locations. These data include those needed to support NFRAP decisions or feasibility studies.

Physical parameters will include the following:

- water levels in wells;

- hydraulic characteristics of aquifers;

- lithologic properties of surface materials, such as grain size, color, rock type; and

- physical and geochemical properties of subsurface materials, including grain-size distribution, bulk density, organic carbon content, cation-exchange capacity, vertical permeability, and moisture content.

These physical properties are needed to estimate the potential for contaminant transport along pathways within the various media. For example, surface water flow rates determine the rates of contaminant transport in surface water, as well as the capacity for attenuation of contaminant concentrations by dilution and dispersion. Groundwater levels and aquifer properties determine the potential for contaminant transport through groundwater, while the physical and geochemical properties of subsurface materials allow estimates to be made of contaminant transport rates through the unsaturated zone and groundwater as influenced by adsorption and dispersion. Lithologic properties of surface materials affect the potential for transport of surface contaminants by erosion and wind.

Chemical constituents that will be determined vary depending on the medium being sampled and the objectives of the analyses. Screening-level analyses of water and

solid media samples will be conducted onsite using colorimetric/immunoassay-based test kits. Screening-level samples will be collected from streams, springs, monitoring wells, surface and subsurface soil, and sediment. The results of screening-level analyses are intended to provide real-time data that can be used to guide field activities and sampling efforts. The screening-level sample analyses will also be used, in part, as criteria for selecting samples for Level II analyses to be submitted to the fixed laboratory. The screening-level analyses may also be useful in supplementing the results of laboratory analyses to help infer the extent of contamination at source areas.

The samples collected for analyses for site characterization and risk assessment purposes will be transported to an offsite, fixed laboratory for analyses of a broad spectrum of compounds, including volatile and semi-volatile organics, pesticides and PCBs, and metals. Specific compounds and analytical methods are discussed in the QAPP (Section 1.0 of the SAP).

Additional data that will be collected include the locations of the sampling points. Both geographic position and elevation of sampling points will be recorded.

The laboratory analyses will be the principal source of information regarding the nature and extent of contamination at source areas. Level II data are required for risk assessment as part of an RI, or to demonstrate the lack of contamination above action levels so that source areas can be demonstrated to be "areas below action levels" (ABALs) for an NFRAP decision.

Field measurements will also be made of various parameters in soil-gas and water samples to provide inferential evidence of ongoing natural attenuation or degradation of contaminants, which may be incorporated into remedial alternatives. Parameters to be measured include oxygen, fuel hydrocarbon vapor content, and carbon dioxide in soil-gas; dissolved oxygen, pH, alkalinity, specific conductance, temperature, and redox potential in groundwater; and aromatic hydrocarbons and total hydrocarbons in soil. Distribution of oxygen, hydrocarbons, and carbon dioxide in soil gas can be used to infer the utilization of oxygen and generation of carbon dioxide during the biodegradation of hydrocarbons in the soil. Distribution of dissolved oxygen, pH, redox potential, and temperature in water indicate areas favorable for biodegradation and geochemical attenuation of contaminant concentrations, and areas where aerobic or anaerobic and reducing or oxidizing conditions may prevail.

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3.0 REMEDIAL INVESTIGATION/FEASIBILITY STUDY TASKS

The following sections describe the RI/FS tasks that will be conducted during the field investigation at Indian Mountain LRRS. The investigation objectives for Lower Camp and Upper Camp are presented in Section 3.1. Section 3.2 specifies the investigative approach including sampling activities, rationales, and locations. Sections 3.3 and 3.4 describe specific investigations and sampling to be conducted at Lower Camp and Upper Camp, respectively.

3.1 INVESTIGATION OBJECTIVES

The objectives of the investigation at Indian Mountain LRRS are based on the conceptual site models (Section 2.3) for both Upper Camp and Lower Camp, and the data needs and uses (Section 2.6). The primary objectives of the RI/FS investigation are:

- to determine the presence and extent of contamination at concentrations exceeding ARARs and background levels;
- to ascertain the physical characteristics of the subsurface soils and groundwater for fate and transport consideration;
- to investigate the interrelationship between surface water and groundwater;
- to determine potential exposure scenarios for surface soil, surface water, sediment and groundwater; and
- to assess physical and biological processes of subsurface soils which may support natural attenuation or biodegradation of contamination as an element of the feasibility study.

The satisfaction of these objectives will provide the data required to complete the remedial investigation and provide the basis for the development and selection of remedial alternatives in the feasibility study.

3.2 FIELD INVESTIGATION APPROACH

In order to accomplish the objectives specified in Section 3.1, certain tasks have been determined to be necessary during the RI/FS field work. The field investigations will be initiated with a field reconnaissance of both Lower and Upper Camps. Because Lower Camp and Upper Camp are geographically, geologically, and hydrologically distinct, field investigative techniques specific to each are proposed.

The purpose of the reconnaissance activities is to locate source areas and waste accumulation areas to be investigated; verify source area maps; identify and map surface features such as seeps, stained soils, surface water drainage and flow patterns; and verify the locations and accessibility of planned sampling points. During the May 1994 site visit, an initial reconnaissance of the Lower Camp was performed. Source areas were identified and mapped, and surface features noted. The reconnaissance to be conducted at Lower Camp in July will consist of locating and mapping sampling points. The reconnaissance activities described were not performed during the May 1994 site visit at the Upper Camp due to snow cover. These activities will be conducted at the beginning of July 1994 field activities.

To determine contaminant types and distribution, the RI/FS data collection will generally be performed in two phases: (1) field surveys and collection of multimedia samples for screening-level analysis, and (2) collection of multimedia samples for site characterization and risk assessment laboratory analysis. The screening tasks include metal detector surveys, soil-gas surveys, and field test kit analysis of groundwater, sediment, and soil samples. The collection of samples for laboratory analysis will be based on RI/FS project objectives and, in part, the results obtained from the screening level analysis. Additional RI/FS data collection activities, including aquifer testing and geotechnical analyses for subsurface soils, will be conducted to determine physical characteristics.

Field surveys and screening techniques will be performed to aid in locating and determining the number of samples for laboratory analysis. With the exception of subsurface soil at predetermined locations, the general approach will be to collect screening level data for field evaluation. Upon review of screening data, determinations can be made regarding the number and location of laboratory samples to be collected from the various media. At several source areas, particularly those where screening and laboratory data have been collected during previous investigations, only samples for laboratory analyses will be collected. The types of samples anticipated for laboratory analysis include subsurface soil, groundwater (Lower Camp only), surface soil, surface water, and sediment.

Section 3.2.1 provides general information regarding the field surveys, screening level analysis, and laboratory analysis. Specific information regarding the location and rationale for the collection of samples from contaminated areas is presented in Section 3.2.3, Lower Camp Investigation, and 3.2.4, Upper Camp Investigation.

3.2.1 Data Collection and Analysis

To aid in characterizing contamination associated with each medium, field surveys will be performed and screening level data will be collected at selected locations to provide qualitative information about source areas and contamination and to help provide direction regarding the location and collection of samples for laboratory analyses for site characterization and risk assessment. Field surveys and screening analysis provide preliminary information regarding potential contaminant distribution whereby the location(s) of laboratory samples can be more accurately assessed. This minimizes the number of laboratory samples required to characterize both camps. A summary of field survey and screening activities is provided in Table 3.2-1, and a summary of laboratory sample collection activities is provided in Table 3.2-2. The field survey, screening data collection, and laboratory data collection activities include the following:

- metal detector surveys of select landfills and Areas of Concern (AOC);
- soil-gas surveys of select waste accumulation areas, landfills, and areas suspected of having subsurface soil contamination;
- collection and analysis of subsurface soil at and downgradient of select waste accumulation areas, landfills, and areas suspected of subsurface contamination;
- collection and analysis of groundwater downgradient of select waste accumulation areas and landfills in the Lower Camp area;

TABLE 3.2–1
FIELD ACTIVITIES SUMMARY
INDIAN MOUNTAIN LRRS, ALASKA

POTENTIAL SOURCE AREA	METAL DETECTOR	SOIL GAS SURVEY	SURFACE WATER SAMPLES	SEDIMENT SAMPLES	SURFACE SOIL SAMPLES (0–0.5 FT)	SHALLOW SUB-SURFACE SOIL SAMPLES (0.5–3 FT)	SUBSURFACE SOIL SAMPLES (1) (>3 FT)	TEST PITS (SS10)	GROUND-WATER SAMPLES (2)	MONITORING WELL INSTALLATION	AQUIFER TESTING
UPPER CAMP											
SS10			X	X				X	X		
SD07			X	X							
SD01			X	X							
OT08		X	X	X	X	X					
GENERAL			X	X							
BACKGROUND		X	X	X	X	X					
TOTAL	0	2	6	6	2	2	0	1	1	0	0
LOWER CAMP											
SS11		X	X	X			X		X	X	X
LF06											
WAA 4							X		X		
LANDFILL 3			X	X		X					
LANDFILL 4			X	X	X	X					
LF04	X			X		X	X		X	X	X
SS02		X					X		X		
SS09			X	X	X	X	X		X	X	X
SS03	X						X		X		
LF05	X		X	X			X		X	X	X
SD07			X	X							
AOC 1			X	X	X	X					
AOC 2					X	X					
AOC 3	X	X	X	X	X	X					
AOC 4		X			X	X					
AOC 5	X		X	X		X					
AOC 6	X		X	X		X					
AOC 7	X		X	X							
AOC 8					X						
AOC 9				X							
AOC 10			X								
OTHER (3)			X								
INDIAN RIVER			X	X							
UTOPIA CREEK			X	X							
BACKGROUND		X	X	X	X		X		X		
TOTAL	7	5	16	16	8	10	8	0	8	4	4

(1) Requires a drill rig.
(2) Groundwater samples collected from temporary wells (Lower Camp) or test pits (Upper Camp).
(3) Includes water treatment system.
(X) Activity to be performed.

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TABLE 3.2-2
FIELD SCREENING/LABORATORY ANALYSIS FIELD ACTIVITIES SUMMARY
INDIAN MOUNTAIN LRRS, ALASKA

POTENTIAL SOURCE AREA	SOIL GAS SURVEY	SURFACE SOIL SCREENING PH (0–0.5 FT)	SURFACE SOIL SCREENING PCB (0–0.5 FT)	SURFACE SOIL SAMPLES LAB (0–0.5 FT)	SCREENING SUB-SURFACE SOIL (0.5–3 FT) PH	SCREENING SUB-SURFACE SOIL (0.5–3 FT) PCB	SUB-SURFACE SOIL (0.5–3 FT) LAB	SUBSURFACE SOIL SCREENING (>3 FT) PH	SUBSURFACE SOIL (>3 FT) LAB	GROUNDWATER SAMPLES SCREENING	GROUNDWATER SAMPLES LAB	SURFACE WATER SAMPLES	SEDIMENT SAMPLES
UPPER CAMP													
SS10	–	–	–	–	–	–	–	–	3	3	3	9	9
SD07	–	–	–	–	–	–	–	–	–	–	–	4	4
SD01	–	–	–	–	–	–	–	–	–	–	–	6	6
OT08	3	–	13	3	–	–	2	–	–	–	–	1	1
GENERAL	–	–	–	–	–	–	–	–	–	–	–	6	6
BACKGROUND	2	–	–	2	–	–	2	–	–	–	–	2	2
TOTAL	5	0	13	5	0	0	4	0	3	3	3	28	28
LOWER CAMP													
SS10	35	–	–	–	–	–	–	3	4	1	1	1	1
LF06													
WAA 4	–	–	–	–	–	–	–	4	2	2	2	–	–
LANDFILL 3	–	–	–	–	4	–	1	–	–	–	–	3	3
LANDFILL 4	–	–	–	1	4	–	1	–	–	–	–	2	2
SD07	–	–	–	–	–	–	–	–	–	–	–	3	3
LF04	–	–	–	–	–	–	4	–	–	3	4	–	1
SS02	12	–	–	–	–	–	–	–	3	3	3	–	–
SS09	–	–	8	1	–	5	2	–	4	4	5	2	2
SS03	–	–	–	–	–	–	–	–	2	2	2	–	–
LF05	–	–	–	–	–	–	–	–	1	1	2	3	3
AOC 1	–	4	–	2	4	–	1	–	–	–	–	1	1
AOC 2	–	16	16	2	9	9	2	–	–	–	–	–	–
AOC 3	8	4	4	2	2	2	1	–	–	–	–	1	1
AOC 4	4	3	–	1	1	–	1	–	–	–	–	–	–
AOC 5	–	–	–	–	2	–	1	–	–	–	–	1	1
AOC 6	–	–	–	–	2	–	1	–	–	–	–	1	1
AOC 7	–	–	–	–	–	–	–	–	–	–	–	7	7
AOC 8	–	–	–	1	–	–	–	–	–	–	–	–	–
AOC 9	–	–	–	–	–	–	–	–	–	–	–	–	1
AOC 10	–	–	–	–	–	–	–	–	–	–	–	1	–
WATER COND. UNIT	–	–	–	–	–	–	–	–	–	3	–	–	–
WASTE CHARACTER.	–	–	–	–	–	–	–	–	10	–	–	–	–
INDIAN RIVER	–	–	–	–	–	–	–	–	–	–	–	2	2
UTOPIA CREEK	–	–	–	–	–	–	–	–	–	–	–	2	2
BACKGROUND	2	–	–	3	–	–	–	–	2	2	–	4	2
TOTAL	61	30	28	13	28	16	15	7	28	21	19	34	33

PCB: Polychlorinated Biphenyls
PH: Petroleum hydrocarbons
(–) Activity/sample not planned.

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- collection and analysis of surface soil samples in areas of obvious soil staining, waste accumulation areas, landfills, and drum storage areas;

- collection and analysis of surface water and sediment samples from seeps, drainages, streams, and rivers; and

- aquifer testing to determine hydraulic characteristics of the shallow groundwater aquifer at the Lower Camp;

At select locations, field screening techniques will be used to define the extent of buried metallic debris, assess surface and subsurface soil contamination, and determine potential contaminant migration via surface water pathways. The screening data will also be used to aid in location of laboratory sampling points by providing real-time information about contaminant presence and extent. General information about screening techniques and sample collection is provided below.

3.2.1.1 <u>Metal Detector Survey</u>

The metal detector survey will be performed at select landfills and areas of suspected subsurface contamination. The survey will be performed to delineate the edges or boundaries of metal-laden fill areas and to assess the continuity, or lack of continuity, of metal-laden fill within survey areas. A grid with approximately 10-foot spacings will be established, and the survey will be conducted continuously along each grid line. The information derived during the metal detector survey will be used to direct the location of soil-gas sample points and to determine the location of downgradient subsurface soil and groundwater samples based on the assumption that subsurface metal accumulations may correspond with locations of other waste disposal areas. Direct drilling into areas of subsurface metal accumulation will be avoided.

The metal detector surveys will be performed using a hand-held pipe and metal locator. A detailed description of the equipment and standard operating procedures are provided in Section 2.0 of the SAP.

3.2.1.2 <u>Soil-Gas Survey</u>

Soil-gas surveys will be conducted in select areas suspected of containing subsurface contamination. Surveys will be performed in waste accumulation areas, landfills, and areas identified during the site visit and reconnaissance. The soil-gas samples will target areas of obvious contamination and those areas identified during the metal detector survey as possibly containing buried drums. The intent of the soil-gas survey is to provide qualitative information regarding subsurface soil contamination. In addition, the data may provide at least indirect evidence of natural biodegradation of organic compounds in the subsurface. The soil-gas data will be used to help determine the location of subsurface soil, groundwater, surface water, and sediment samples collected at and downgradient of the contaminated areas.

The collection of qualitative soil-gas samples is detailed in Section 2.1.3 of the SAP. The screening level analysis to be performed on the soil-gas samples will include the presence of volatile organic compounds using a photoionization detector (PID) instrument. In addition, the nature of subsurface conditions will be qualitatively determined by analyzing for subsurface oxygen content, carbon dioxide, and volatile organic compounds. These data will provide information important in feasibility study considerations.

3.2.1.3 Surface Soil Sampling

Surface soil samples collected for analysis will be obtained from known waste accumulation areas and areas of obvious surface contamination discovered during the May 1994 site visit and the reconnaissance. The waste accumulation areas principally include known areas of drum storage, former POL storage, and known surface contamination. The exact number and location of surface soil samples will be determined after evaluating all information collected during the reconnaissance at the Upper Camp. At the Lower Camp, the number and location of surface soil sampling points was preliminarily determined during the site visit. The location of surface soil samples will target those areas where the potential for off-site migration to surface water exists. Surface soil will also be collected in areas where seeps containing visual contamination are observed.

Surface soil samples collected for screening analysis will be qualitatively field analyzed for volatile organic, PCB, and/or petroleum hydrocarbon contamination. Qualitatively determining the presence of volatile organic compounds will be performed by using a PID organic vapor detector. Relative concentrations of PCB and petroleum hydrocarbon contamination will be assessed by means of field test kits using immunoassay techniques.

Surface soil samples obtained for screening analysis will be collected as described in the SAP. Surface soil samples are those collected from the ground surface to 6 inches below ground surface. Shallow subsurface soil samples are those collected from 6 inches to 3 feet below ground surface.

Surface soil will be collected for laboratory analysis as described in Table 3.2-3. Surface soil will be analyzed to quantitatively assess the type and concentration of contaminants present. Surface soil will be collected for laboratory analysis in areas of obvious contamination based on the results of the field screening analysis. The intent is to characterize those potentially contaminated soils that have the greatest potential for overland migration to surface water. The exact location of surface soil samples collected will be determined after the reconnaissance and surface soil screening analysis.

3.2.1.4 Subsurface Soil Sampling

Based on historical information, the May 1994 site visit, and the findings of the field reconnaissance, the metal detector survey, surface soil screening analysis, and the soil-gas survey, subsurface soil samples will be collected within and downgradient of the landfills, waste accumulation areas, and areas identified during the reconnaissance as potentially containing subsurface contamination. Subsurface soil samples will be collected at depths at or near the water table or at subsurface zones of obvious contamination. Subsurface soil samples will be collected to assess the presence and potential migration to downgradient areas of contaminants from waste accumulation areas, landfills, and potential areas containing subsurface contamination. It is anticipated that fuel-related contamination will migrate at or near the water table where groundwater is present.

The intent of subsurface soil sample collection for screening analyses is to qualitatively determine the presence of volatile organic compounds and relative concentration of petroleum hydrocarbon contaminants in subsurface soils. The presence of volatile organic contaminants will be assessed using a PID organic

TABLE 3.2–3
SURFACE SOIL ANALYTICAL SUMMARY
INDIAN MOUNTAIN LRRS, ALASKA

	LABORATORY ANALYSES					
POTENTIAL SOURCE AREA	DRO/GRO/RRO SW8100/ SW8015/AK103 (mg/kg)	VOLATILE ORGANICS SW8240 (mg/kg)	SEMI–VOLATILES SW8270 (mg/kg)	PESTICIDES/ PCBs SW8080 (mg/kg)	ICP METALS, total SW6010 (mg/kg)	TOTAL LAB
UPPER CAMP						
SS10	–	–	–	–	–	0
SD07	–	–	–	–	–	0
SD01	–	–	–	–	–	0
OT08	3	3	3	3	3	15
BACKGROUND	2	2	2	2	2	10
TOTAL	5	5	5	5	5	25
LOWER CAMP						
SS11	–	–	–	–	–	0
LF06						
WAA 4	–	–	–	–	–	0
LANDFILL 3	–	–	–	–	–	0
LANDFILL 4	1	1	1	1	1	5
SD07	–	–	–	–	–	0
LF04	–	–	–	–	–	0
SS02	–	–	–	–	–	0
SS09	1	1	1	1	1	5
SS03	–	–	–	–	–	0
LF05	–	–	–	–	–	0
AOC 1	2	2	2	–	–	6
AOC 2	2	–	2	2	–	6
AOC 3	2	2	2	2	2	10
AOC 4	1	1	1	–	–	3
AOC 5	–	–	–	–	–	0
AOC 6	–	–	–	–	–	0
AOC 7	–	–	–	–	–	0
AOC 8	1	1	1	–	1	4
AOC 9	–	–	–	–	–	0
AOC 10	–	–	–	–	–	0
BACKGROUND	3	3	3	3	3	15
TOTAL	13	11	13	9	8	54

vapor detector. The presence and relative concentrations of PCBs and petroleum hydrocarbons will be determined by means of field test kits employing immunoassay techniques. The screening analysis of subsurface soils will provide information regarding contaminant presence and extent and help direct the location of possible additional samples to be collected for laboratory analyses.

In addition to screening level analysis, subsurface soil will be collected for laboratory analysis as described in Table 3.2-4. Subsurface soil analysis will be performed to quantitatively assess the type and concentration of contamination. The exact location of each subsurface soil sample collected will be determined in the field.

The purpose of analyzing these samples for laboratory confirmation is to provide defensible data for potentially contaminated areas. These analytical results will not be available during the field season; thus, screening data will primarily be used for field decisions regarding additional subsurface soil sampling points.

The location of additional subsurface soil samples for laboratory analysis will be determined by evaluating the screening level information and data derived from the reconnaissance activities, metal detector survey, soil-gas survey, subsurface soil screening data, and groundwater screening data.

Subsurface soil samples collected for screening analysis will be obtained at the Lower Camp through the drill rig hollow-stem augers, and at the Upper Camp from tests pits excavated by backhoe, if available. Samples will be collected as specified in the SAP. Subsurface soil samples are those samples collected from depths greater than 3 feet.

3.2.1.5 Groundwater Sampling

Groundwater samples will be collected for laboratory analysis downgradient of waste accumulation areas, landfills, and other potential sources identified during the reconnaissance. At select locations, groundwater will be collected for rapid (5 day) analysis by the laboratory. Because significant groundwater is not anticipated at the Upper Camp, groundwater samples will be collected only at areas within and near the Lower Camp. The location of preliminary groundwater collection points was established during the May 1994 site visit. The groundwater samples will be collected in the boreholes where subsurface soil samples are collected.

Groundwater samples will be collected downgradient of waste accumulation areas, landfills, and other potential areas identified during the site visit to determine whether groundwater contamination is migrating from these areas. Groundwater samples will be collected for laboratory analysis. After the collection and analysis of all field data, the location of permanent monitoring wells or additional "single sample" groundwater points will be established.

Groundwater samples will be collected from within temporary monitoring wells. Field screening of groundwater for petroleum hydrocarbons will be conducted using immunoassay test kits. Confirmatory samples will be sent to the laboratory for quick turnaround (five-day) analysis. If contamination is present, additional samples will be collected downgradient for both field screening and quick turnaround analysis until the absence of contamination is confirmed. Details regarding specific sample collection are presented in the SAP.

Groundwater samples collected for laboratory analysis will be analyzed as specified in Table 3.2-5. Groundwater samples will be collected from boreholes downgradient

TABLE 3.2–4
SUBSURFACE SOIL ANALYTICAL SUMMARY
INDIAN MOUNTAIN LRRS, ALASKA

POTENTIAL SOURCE AREA	LABORATORY ANALYSES							
	DRO/GRO/RRO SW8100/ SW8015/AK103 (mg/kg)	VOLATILE ORGANICS SW8240 (mg/kg)	SEMI–VOLATILES SW8270 (mg/kg)	PESTCIDES/ PCBs SW8080 (mg/kg)	ICP METALS, total SW6010 (mg/kg)	GEOTECH SAMPLE	TCLP	TOTAL LAB
UPPER CAMP								
SS10	3	3	3	3	3	–	–	15
SD07	–	–	–	–	–	–	–	0
SD01	–	–	–	–	–	–	–	0
OT08	2	2	2	2	2	–	–	10
BACKGROUND	2	2	2	2	2	–	–	10
TOTAL	7	7	7	7	7	0	0	35
LOWER CAMP								
SS11	4	4	4	–	–	1	–	13
LF06							–	0
WAA 4	2	2	–	2	2	–	–	8
LANDFILL 3	1	1	1	1	1	–	–	5
LANDFILL 4	1	1	1	1	1	–	–	5
SD07	–	–	–	–	–	–	–	0
LF04	4	4	–	4	4	–	–	16
SS02	3	3	3	–	3	–	–	12
SS09	6	6	6	6	6	1	–	31
SS03	2	2	2	2	2	–	–	10
LF05	1	1	1	1	1	–	–	5
AOC 1	1	1	1	–	–	–	–	3
AOC 2	2	–	2	2	–	–	–	6
AOC 3	1	1	1	1	1	–	–	5
AOC 4	1	1	1	–	–	–	–	3
AOC 5	1	1	1	–	1	–	–	4
AOC 6	1	1	1	–	1	–	–	4
AOC 7	–	–	–	–	–	–	–	0
AOC 8	–	–	–	–	–	–	–	0
AOC 9	–	–	–	–	–	–	–	0
AOC 10	–	–	–	–	–	–	–	0
WASTE CHAR.	–	–	–	–	–	–	10	10
BACKGROUND	2	2	2	2	2	–	–	10
TOTAL	33	31	27	22	25	2	10	150

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of potentially contaminated areas. These laboratory analytical data will serve to characterize the type and concentration of groundwater contamination directly downgradient of the potentially contaminated areas. The location of additional groundwater sampling points will be determined based on the reconnaissance, metal detector survey, soil-gas data, inferred groundwater flow directions, and data derived from the field screening of subsurface soils and groundwater.

3.2.1.6 Surface Water and Sediment Sampling

Surface water samples will only be collected at locations where obvious or potential contamination is present, as determined during the site visit and reconnaissance. These locations include seeps and surface water drainages if water is present at the time of the field investigation.

Surface water samples will be collected according to the methods described in the SAP.

Surface water samples will be collected for laboratory analysis according to the methods described in Table 3.2-6. The analysis of surface water samples will be performed to quantitatively determine the type and concentration of contamination. Surface water samples will be collected from seep areas at both Upper and Lower Camp. Surface water will also be collected from upgradient and downgradient locations on Indian River and Utopia Creek. At the Upper Camp, surface water samples will be collected from drainages and tributaries emanating from the Upper Camp and from locations of surface water accumulation adjacent to source areas.

The exact location and number of surface water samples collected will be based on the reconnaissance and field screening results for surface soils.

Sediment samples will be collected primarily as co-located samples at surface water collection locations. However, it is anticipated that some drainages emanating from waste accumulation areas, landfills, or other potentially contaminated areas will not contain sufficient water to sample. At these locations, sediment samples will be collected to determine the presence of contaminant migration from these areas. The location of sediment samples will be based, in part, on known drainages, drainages identified during the reconnaissance, and drainages identified during the site visit.

Sediment samples collected for screening analysis are intended to provide qualitative information regarding the presence of contamination in surface water drainages. The information derived from the analysis of sediment samples will be used to determine the location of sediment samples for laboratory analysis. Sediment samples will be field analyzed for volatile organic compounds using a PID organic vapor detector. Petroleum hydrocarbon contamination and PCB contamination will be qualitatively assessed using field test kits.

Sediment samples will be collected for laboratory analysis according to methods described in Table 3.2-7. Sediment samples will be analyzed to determine the type and concentration of contaminants located in surface water drainages that are potentially amenable to surface water transport. Sediment samples will be collected in areas of potential contamination based on the reconnaissance and the data derived from the field screening of sediment samples. The collection of sediment samples for screening analysis is presented in the SAP.

TABLE 3.2-5
GROUNDWATER ANALYTICAL SUMMARY
INDIAN MOUNTAIN LRRS, ALASKA

	LABORATORY ANALYSES											
POTENTIAL SOURCE AREA	DRO/GRO SW8100/ SW8015 (µg/l)	VOLATILE ORGANICS SW8260 (µg/l)	SEMI-VOLATILES SW8270 (µg/l)	PCBs/ PESTCIDES SW8080 (µg/l)	ICP METALS, total SW6010 (mg/l)	COMMON ANIONS SW9056 (mg/l)	GFAA METAL * ARSENIC SW7060 (µg/l)	GFAA METAL * LEAD SW7421 (µg/l)	GFAA METAL * CADMIUM SW7131 (µg/l)	GFAA METAL * CHROMIUM SW7191 (µg/l)	COLD VAPOR EXTRACTION MERCURY SW7470 (µg/l)	TOTAL LAB
UPPER CAMP												
SS10	3	3	3	3	3	3	3	3	3	3	–	30
SD07	–	–	–	–	–	–	–	–	–	–	–	0
SD01	–	–	–	–	–	–	–	–	–	–	–	0
OT08	–	–	–	–	–	–	–	–	–	–	–	0
BACKGROUND	–	–	–	–	–	–	–	–	–	–	–	0
TOTAL	3	3	3	3	3	3	3	3	3	3	0	30
LOWER CAMP												
SS11	1	1	1	–	1	1	–	–	–	–	–	5
LF06												
WAA 4	2	2	–	2	2	2	2	2	2	2	2	20
LANDFILL 3	–	–	–	–	–	–	–	–	–	–	–	0
LANDFILL 4	–	–	–	–	–	–	–	–	–	–	–	0
SD07	–	–	–	–	–	–	–	–	–	–	–	
LF04	4	4	4	4	4	4	4	4	4	4	4	44
SS02	3	3	3	–	3	3	3	–	–	–	–	18
SS09	5	5	5	5	5	5	3	4	3	3	4	47
SS03	2	2	2	2	2	2	2	2	2	2	–	20
LF05	2	2	2	2	2	2	2	2	2	2	2	22
AOC 1	–	–	–	–	–	–	–	–	–	–	–	0
AOC 2	–	–	–	–	–	–	–	–	–	–	–	0
AOC 3	–	–	–	–	–	–	–	–	–	–	–	0
AOC 4	–	–	–	–	–	–	–	–	–	–	–	0
AOC 5	–	–	–	–	–	–	–	–	–	–	–	0
AOC 6	–	–	–	–	–	–	–	–	–	–	–	0
AOC 7	–	–	–	–	–	–	–	–	–	–	–	0
AOC 8	–	–	–	–	–	–	–	–	–	–	–	0
AOC 9	–	–	–	–	–	–	–	–	–	–	–	0
AOC 10	–	–	–	–	–	–	–	–	–	–	–	0
WATER COND. UNIT	3	3	–	–	–	–	–	–	–	–	–	6
BACKGROUND	2	2	2	2	2	2	2	2	2	2	2	22
TOTAL	24	24	19	17	21	21	18	16	15	15	14	204

* GFAA Metals analytical suite dependent upon location.

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TABLE 3.2–6
SURFACE WATER ANALYTICAL SUMMARY
INDIAN MOUNTAIN LRRS, ALASKA

POTENTIAL SOURCE AREA	LABORATORY ANALYSES DRO/GRO SW8100/ SW8015 (μg/l)	VOLATILE ORGANICS SW8260 (μg/l)	SEMI-VOLATILES SW8270 (μg/l)	PESTICIDES/ PCBs SW8080 (μg/l)	ICP METALS, total SW6010 (mg/l)	COMMON ANIONS SW9056 (mg/l)	GFAA METAL * ARSENIC SW7060 (μg/l)	GFAA METAL * LEAD SW7421 (μg/l)	GFAA METAL * CADMIUM SW7131 (μg/l)	GFAA METAL * CHROMIUM SW7191 (μg/l)	GFAA METAL * MERCURY SW7470 (μg/l)	TOTAL LAB
UPPER CAMP												
SS10	9	9	9	9	9	9	9	9	9	9	–	90
SD07	4	4	4	4	4	4	–	4	–	–	–	28
SD01	6	6	6	6	6	6	6	6	6	6	–	60
OT08	1	1	1	1	1	1	–	–	–	–	–	6
GENERAL	6	6	6	6	6	6	6	6	6	6	–	60
BACKGROUND	2	2	2	2	2	2	2	2	2	2	2	22
TOTAL	28	28	28	28	28	28	23	27	23	23	2	266
LOWER CAMP												
SS11	1	1	1	–	1	1	–	–	–	–	–	5
LF06												
WAA 4	–	–	–	–	–	–	–	–	–	–	–	0
LANDFILL 3	3	3	3	3	3	3	3	–	–	–	–	21
LANDFILL 4	2	2	2	2	2	2	2	–	–	–	–	14
SD07	3	3	3	3	3	3	–	3	–	–	–	21
LF04	–	–	–	–	–	–	–	–	–	–	–	0
SS02	–	–	–	–	–	–	–	–	–	–	–	0
SS09	2	2	2	1	2	2	1	2	1	1	1	17
SS03	–	–	–	–	–	–	–	–	–	–	–	0
LF05	3	3	3	3	3	3	3	3	3	3	3	33
AOC 1	1	1	1	–	–	–	–	–	–	–	–	3
AOC 2	–	–	–	–	–	–	–	–	–	–	–	0
AOC 3	1	1	1	1	1	1	1	1	1	1	1	11
AOC 4	–	–	–	–	–	–	–	–	–	–	–	0
AOC 5	1	1	1	–	1	1	1	1	1	1	1	10
AOC 6	1	1	1	–	1	1	1	1	1	1	1	10
AOC 7	7	7	7	7	7	7	7	7	7	7	–	70
AOC 8	–	–	–	–	–	–	–	–	–	–	–	0
AOC 9	–	–	–	–	–	–	–	–	–	–	–	0
AOC 10	1	1	1	1	1	–	–	–	–	–	–	5
INDIAN RIVER	2	2	2	2	2	2	2	2	2	2	2	22
UTOPIA CREEK	2	2	2	2	2	2	2	2	2	2	2	22
BACKGROUND	4	4	4	4	4	4	4	4	4	4	4	44
TOTAL	34	34	34	29	33	32	27	26	22	22	15	308

* GFAA Metals analytical suite dependent upon location.

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TABLE 3.2-7
SEDIMENT ANALYTICAL SUMMARY
INDIAN MOUNTAIN LRRS, ALASKA

POTENTIAL SOURCE AREA	LABORATORY ANALYSES: DRO/GRO/RRO SW8100/ SW8015/AK103 (mg/kg)	VOLATILE ORGANICS SW8240 (mg/kg)	SEMI-VOLATILES SW8270 (mg/kg)	PESTICIDES/ PCBs SW8080 (mg/kg)	ICP METALS, total SW6010 (mg/kg)	TCLP	TOTAL LAB
UPPER CAMP							
SS10	9	9	9	9	9	–	45
SD07	4	4	4	4	4	–	20
SD01	6	6	6	6	6	–	30
OT08	1	1	1	1	1	–	5
GENERAL	6	6	6	6	6	–	30
BACKGROUND	2	2	2	2	2	–	10
TOTAL	28	28	28	28	28	0	140
LOWER CAMP							
SS11	1	1	1	–	–	–	3
LF06							
WAA 4	–	–	–	–	–	–	0
LANDFILL 3	3	3	3	3	3	–	15
LANDFILL 4	2	2	2	2	2	–	10
SD07	3	3	3	3	3	–	15
LF04	1	1	–	1	1	–	4
SS02	–	–	–	–	–	–	0
SS09	2	2	2	1	2	–	9
SS03	–	–	–	–	–	–	0
LF05	3	3	3	3	3	–	15
AOC 1	1	1	1	–	–	–	3
AOC 2	–	–	–	–	–	–	0
AOC 3	1	1	1	1	1	–	5
AOC 4	–	–	–	–	–	–	0
AOC 5	1	1	1	–	1	–	4
AOC 6	1	1	1	–	1	–	4
AOC 7	7	7	7	7	7	–	35
AOC 8	–	–	–	–	–	–	0
AOC 9	–	–	–	–	–	1	1
AOC 10	–	–	–	–	–	–	0
INDIAN RIVER	2	2	2	2	2	–	10
UTOPIA CREEK	2	2	2	2	2	–	10
BACKGROUND	2	2	2	2	2	–	10
TOTAL	32	32	31	27	30	1	153

Recycled

3.3 LOWER CAMP INVESTIGATION

Lower Camp, located at the base of Indian Mountain, is currently used as the primary radar station operations and maintenance facility. The facilities at Lower Camp include housing, station maintenance, fuels storage areas, sewage and waste water treatment, drinking water supply, and the landing strip. The general Lower Camp area is devoid of trees; however, grasses are prevalent. The area surrounding Lower Camp is heavily wooded with deciduous and coniferous trees.

Contaminants of potential concern identified from previous investigations at Lower Camp include POLs, PCBs, pesticides, solvents, and metals. Currently eight potential source areas at the Lower Camp have been identified as possible areas where hazardous waste may have been released, stored, or disposed. The locations of these sites at Lower Camp are shown in Figure 2.2-1.

During the May 1994 site visit, AOCs were observed. These AOCs are currently not considered IRP source areas at Indian Mountain. In order to assess contaminant presence and extent in these areas, AOC-specific investigations are proposed.

As discussed in preceding sections, the field investigation at the Lower Camp will include screening activities and analyses that will be performed to determine the location and number of samples for laboratory analysis and the need for further characterization of environmental media. The following sections provide information regarding the source area and AOC-specific rationale for investigation activities and preliminary locations for sample collection. The sections discuss the individual surveys and investigation techniques that will be used in the Lower Camp investigation. Section 3.3.1 describes the investigations to be conducted at the IRP Source Areas and Section 3.3.2 describes the investigations planned at the AOC. Included in the AOC discussions is information regarding use and history of each AOC.

3.3.1 IRP Source Areas

The Lower Camp includes eight identified IRP source areas including SS02, SS03, LF04, LF05, LF06, SS09, and SS11. In addition, the runway oiling at the Lower Camp is included as source area SD07. Source area SD07 also includes roadway oiling, which, for consistency with the conceptual site model, is presented as part of the Upper Camp discussion.

3.3.1.1 Source Area SS02

Source area SS02 is located along the northeast side of the runway. As discussed in Section 2.2.5, this area was used as a drummed waste storage area from the 1950s to the mid-1980s. During the site visit, this area appeared to have been recently graded with no obvious signs of surface contamination. The area is currently used as a storage area for miscellaneous metal equipment and materials. The location of source area SS02 is shown in Figure 2.2-1.

The RI/FS investigative activities at SS02 will be focussed on determining the presence of subsurface contamination resulting from potential spills of waste material. If contamination is present in subsurface soils, it is possible that contaminants may be migrating to Indian River or Utopia Creek. Because of the age of potential spills, a soil gas survey will be performed primarily to assess the oxygen and carbon dioxide levels for feasibility study considerations. The location of

boreholes will be determined in the field, pending review of the soil-gas data. The tentative locations of soil-gas probes and boreholes are presented in Figure 3.3-1.

The soil-gas survey will be performed by establishing a grid over the area of SS02. For planning purposes, 12 soil-gas points are estimated. Subsurface soils and groundwater will be collected from an estimated three boreholes at SS02. The subsurface soil samples will be collected at the groundwater interface and at areas of obvious contamination. Groundwater and subsurface soils will be collected as described in the SAP. The laboratory analyses for subsurface soil include DRO/GRO/RRO, VOC, SVOC, and ICP metals. The analysis for the groundwater samples will include DRO/GRO, VOC, SVOC, common anions, ICP metals, and arsenic by GFAA.

3.3.1.2 Source Area SS03

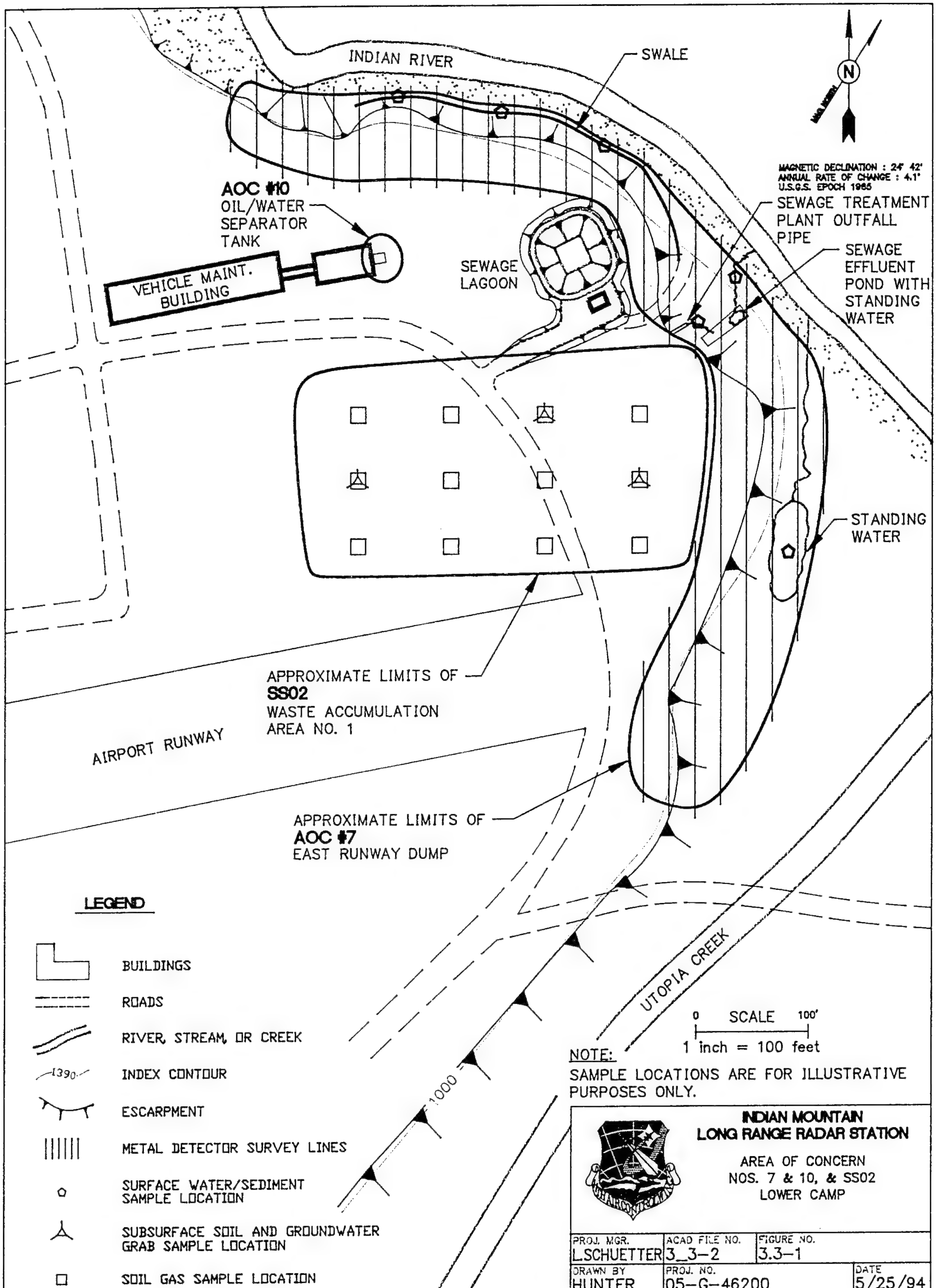
Source area SS03 is located on the north side of the road to Upper Camp, north of Indian River (Figure 3.3-2). This source area was used as a waste storage area during the 1960s and 1970s. Spills and leaks were reported to have occurred at the site. During the May 1994 site visit, no obvious signs of contamination were observed. The area is identifiable by relatively new alder growth and surface grading.

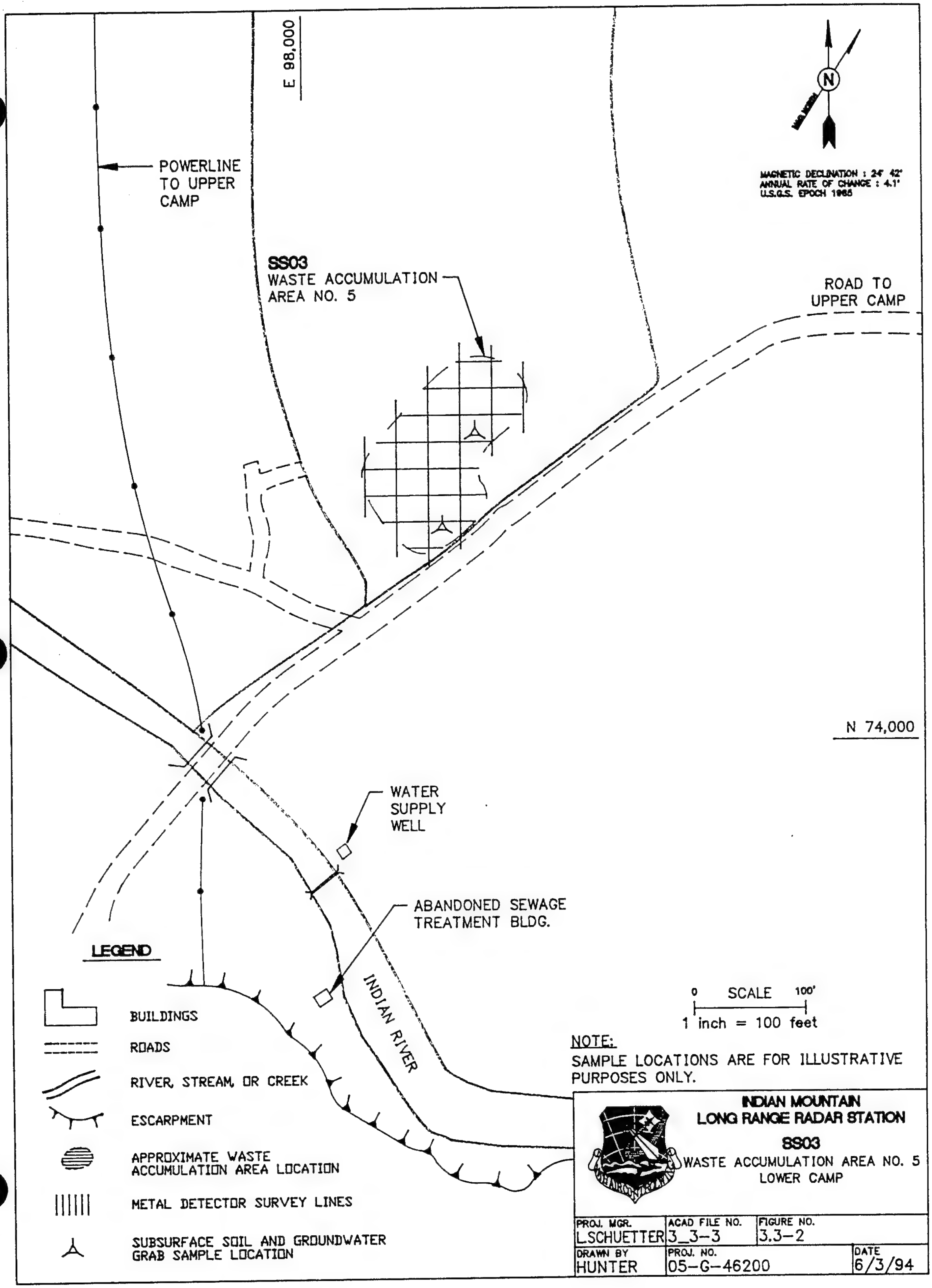
The investigation at this source area will be conducted to determine the presence of buried metallic debris and the presence of subsurface contamination. If contamination is present in subsurface soils, the potential exists for contaminant transport to Indian River by the groundwater pathway. To identify potential buried contaminant sources and determine the presence of subsurface contamination, a metal-detector survey will be performed and subsurface soil and groundwater will be collected.

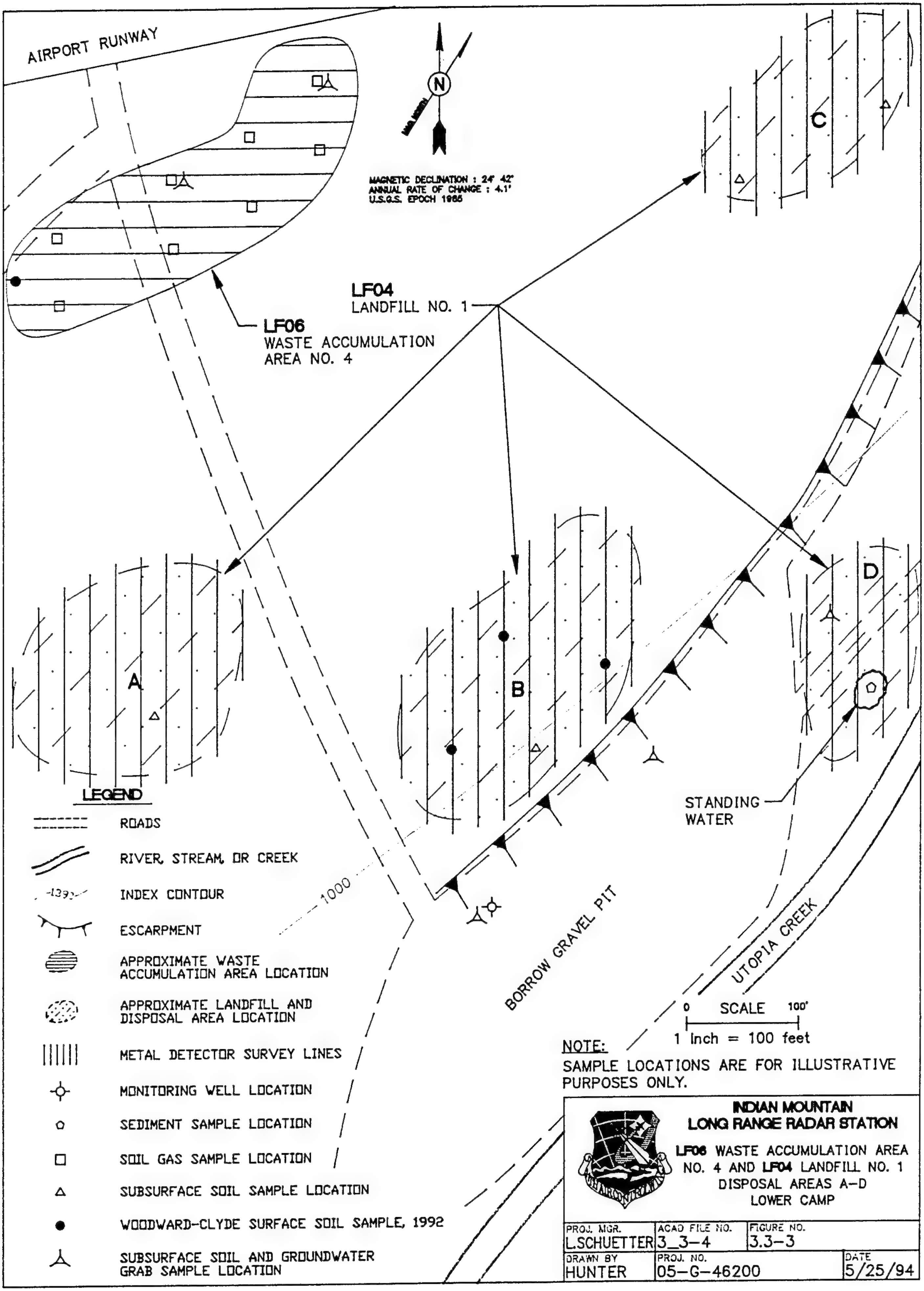
A metal-detector survey will be performed over the entire area of SS03. The survey will be conducted to assess the presence of subsurface metallic debris. The survey may direct locating two planned boreholes at this source area. Because the land slope and inferred groundwater flow is to the south toward Indian River, the boreholes will be drilled at downgradient locations within the source area in an attempt to detect contamination. Subsurface soil from the boreholes will be collected at the groundwater interface or at zones of obvious contamination. The laboratory analysis for subsurface soils will include DRO/GRO/RRO, VOC, SVOC, pesticides/PCBs, and ICP metals. Groundwater will be collected for analysis including DRO/GRO/RRO, VOC, SVOC, pesticides/PCBs, common anions, ICP and GFAA metals (lead, cadmium, chromium, arsenic).

3.3.1.3 Source Area LF04

In previous literature, source area LF04 has been identified as an approximate one-acre landfill located north of the gravel pits on Utopia Creek. Engineering-Science (Air Force 1985) reported that this landfill was used for the disposal of miscellaneous waste including garbage, scrap lumber, metal waste, and small quantities of shop waste. This area was identified and three additional areas potentially associated with LF04 were observed during the May 1994 site visit. These three areas have been included as part of the investigation of LF04. As shown in Figure 3.3-3, these areas have been subdivided into areas A, B, C, and D. Area B is assumed to be the original source area.


INDIAN RIVER
SWALE
N
MAGNETIC DECLINATION : 24° 42'
ANNUAL RATE OF CHANGE : 4.1'
U.S.G.S. EPOCH 1965
AOC #10
OIL/WATER SEPARATOR TANK
VEHICLE MAINT. BUILDING
SEWAGE LAGOON
SEWAGE TREATMENT PLANT OUTFALL PIPE
SEWAGE EFFLUENT POND WITH STANDING WATER
STANDING WATER
APPROXIMATE LIMITS OF
SS02
WASTE ACCUMULATION AREA NO. 1
AIRPORT RUNWAY
APPROXIMATE LIMITS OF
AOC #7
EAST RUNWAY DUMP
UTOPIA CREEK
1000
0 SCALE 100'
1 inch = 100 feet
NOTE:
SAMPLE LOCATIONS ARE FOR ILLUSTRATIVE PURPOSES ONLY.
LEGEND
BUILDINGS
ROADS
RIVER, STREAM, OR CREEK
1390
INDEX CONTOUR
ESCARPMENT
METAL DETECTOR SURVEY LINES
SURFACE WATER/SEDIMENT SAMPLE LOCATION
SUBSURFACE SOIL AND GROUNDWATER GRAB SAMPLE LOCATION
SOIL GAS SAMPLE LOCATION
INDIAN MOUNTAIN LONG RANGE RADAR STATION
AREA OF CONCERN NOS. 7 & 10, & SS02 LOWER CAMP
PROJ. MGR. L.SCHUETTER
ACAD FILE NO. 3_3-2
FIGURE NO. 3.3-1
DRAWN BY HUNTER
PROJ. NO. 05-G-46200
DATE 5/25/94


E 98,000
N
MAGNETIC DECLINATION : 24° 42'
ANNUAL RATE OF CHANGE : 4.1'
U.S.G.S. EPOCH 1966
POWERLINE TO UPPER CAMP
SS03
WASTE ACCUMULATION AREA NO. 5
ROAD TO UPPER CAMP
N 74,000
WATER SUPPLY WELL
ABANDONED SEWAGE TREATMENT BLDG.
INDIAN RIVER
LEGEND
BUILDINGS
ROADS
RIVER, STREAM, OR CREEK
ESCARPMENT
APPROXIMATE WASTE ACCUMULATION AREA LOCATION
METAL DETECTOR SURVEY LINES
SUBSURFACE SOIL AND GROUNDWATER GRAB SAMPLE LOCATION
0 SCALE 100'
1 inch = 100 feet
NOTE:
SAMPLE LOCATIONS ARE FOR ILLUSTRATIVE PURPOSES ONLY.
INDIAN MOUNTAIN
LONG RANGE RADAR STATION
SS03
WASTE ACCUMULATION AREA NO. 5
LOWER CAMP
PROJ. MGR. L.SCHUETTER
ACAD FILE NO. 3_3-3
FIGURE NO. 3.3-2
DRAWN BY HUNTER
PROJ. NO. 05-G-46200
DATE 6/3/94


AIRPORT RUNWAY
N
MAGNETIC DECLINATION : 24° 42'
ANNUAL RATE OF CHANGE : 4.1'
U.S.G.S. EPOCH 1985
C
LF04
LANDFILL NO. 1
LF06
WASTE ACCUMULATION
AREA NO. 4
A
B
D
STANDING
WATER
1000
BORROW GRAVEL PIT
UTOPIA CREEK
0 SCALE 100'
1 Inch = 100 feet
NOTE:
SAMPLE LOCATIONS ARE FOR ILLUSTRATIVE PURPOSES ONLY.
LEGEND
ROADS
RIVER, STREAM, OR CREEK
INDEX CONTOUR
ESCARPMENT
APPROXIMATE WASTE ACCUMULATION AREA LOCATION
APPROXIMATE LANDFILL AND DISPOSAL AREA LOCATION
METAL DETECTOR SURVEY LINES
MONITORING WELL LOCATION
SEDIMENT SAMPLE LOCATION
SOIL GAS SAMPLE LOCATION
SUBSURFACE SOIL SAMPLE LOCATION
WOODWARD-CLYDE SURFACE SOIL SAMPLE, 1992
SUBSURFACE SOIL AND GROUNDWATER GRAB SAMPLE LOCATION
INDIAN MOUNTAIN
LONG RANGE RADAR STATION
LF06 WASTE ACCUMULATION AREA
NO. 4 AND LF04 LANDFILL NO. 1
DISPOSAL AREAS A-D
LOWER CAMP
PROJ. MGR. L.SCHUETTER
ACAD FILE NO. 3_3-4
FIGURE NO. 3.3-3
DRAWN BY HUNTER
PROJ. NO. 05-G-46200
DATE 5/25/94

Generally, the investigations at areas A, B, C, and D will be consistent. The objective of the investigation at each area is to determine the presence and relative extent of subsurface metallic disposal and determine the presence of subsurface soil contamination by means of groundwater and subsurface soil collection. Metal-detector surveys will be performed at all four areas. At areas A, B, and C, shallow (3 feet) subsurface soils will be sampled to determine the presence of contamination. At area D, located in the flood plain of Utopia Creek, sediment will be collected for analysis. In addition to characterizing the near surface contamination within each area, boreholes will be drilled at the assumed downgradient edge of these four areas to assess contaminant migration via the groundwater pathway and to determine the potential for contaminant migration to Utopia Creek. Groundwater contamination will also be assessed by means of one monitoring well at the downgradient location. These boreholes and the monitoring well will be located in the gravel pit area adjacent to the creek. The proposed locations of all sampling points within the LF04 source are presented in Figure 3.3-4. Sampling locations will be finalized following the summer 1994 site reconnaissance.

One shallow subsurface soil sample will be collected from each of areas A and B, two shallow subsurface soil samples from area C, and one sediment sample from area D will be collected for laboratory analysis to include DRO/GRO/RRO, VOC, pesticides/PCBs, and ICP metals.

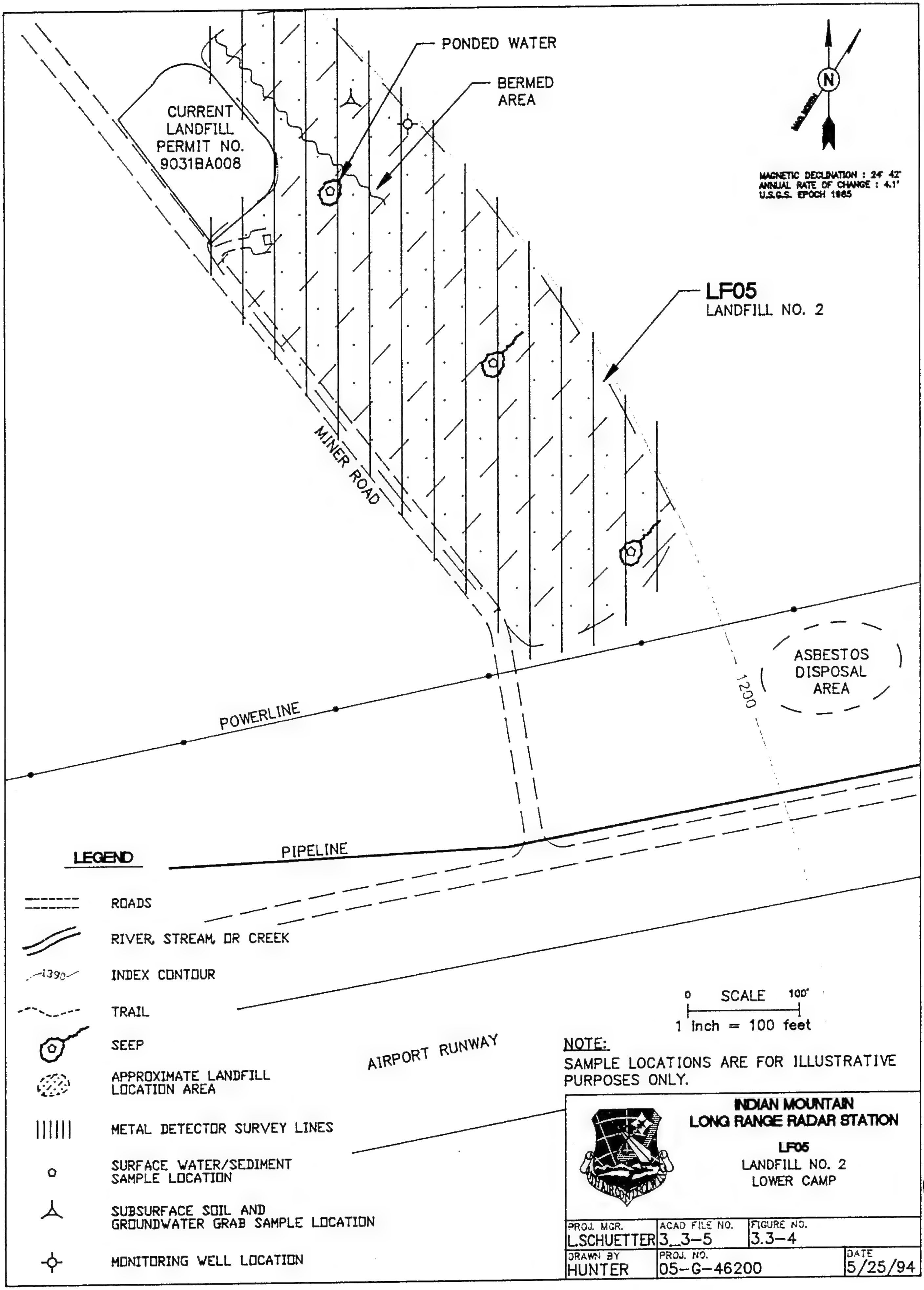
During the drilling of the three boreholes, only groundwater will be collected for analysis. Based on field observations, two of the three borehole groundwater samples will be sent to the laboratory for rapid turn-around analysis. The third groundwater sample will be sent to the laboratory for normal turn-around analysis. These analyses include DRO/GRO, VOC, SVOC, pesticides/PCBs, common anions, ICP and GFAA metals, and mercury by the cold-vapor method. The rapid turn-around data will provide direction for locating the monitoring well. The analysis of groundwater collected from the monitoring well will include DRO/GRO, VOC, SVOC, pesticides/PCBs, common anions, ICP and GFAA metals, and mercury by the cold-vapor method.

3.3.1.4 Source Area LF05

Source area LF05 consists of landfill no. 2, located along Miner Road just north of the runway near its western end. LF05 covers an area of approximately two acres. This landfill, which remains the active disposal area for the facility, has been in operation since 1977. The landfill uses trenches 15 to 20 feet deep for disposal of incinerator ash, wood, metal, oil filters, empty drums, fuel absorbent, oil spill residue, paint residuals, and construction debris. Combustible materials are usually burned. A separate asbestos disposal area is located southeast of LF05, adjacent to the runway.

During the May 1994 site visit, two seeps and an area of ponded water were observed at LF05. One seep is located at the southern end of LF05, near the asbestos disposal area. The second seep is located along the eastern edge of LF05, near an abandoned Caterpillar tractor. The area of ponded water is located in the northern part of LF05, just below the incinerator building.

Field investigations at LF05 will include a metal-detector survey to help locate areas where drums and other metallic debris might be buried and to help identify the lateral extent of past landfill operations. Surface water, sediment, subsurface soil, and groundwater samples will also be collected. Proposed sample locations based


PONDED WATER
BERMED AREA
CURRENT LANDFILL PERMIT NO. 9031BA008
MAGNETIC DECLINATION : 24° 42'
ANNUAL RATE OF CHANGE : 4.1'
U.S.G.S. EPOCH 1985
LF05
LANDFILL NO. 2
MINER ROAD
ASBESTOS DISPOSAL AREA
1200
POWERLINE
PIPELINE
AIRPORT RUNWAY
LEGEND
ROADS
RIVER, STREAM, OR CREEK
1390
INDEX CONTOUR
TRAIL
SEEP
APPROXIMATE LANDFILL LOCATION AREA
METAL DETECTOR SURVEY LINES
SURFACE WATER/SEDIMENT SAMPLE LOCATION
SUBSURFACE SOIL AND GROUNDWATER GRAB SAMPLE LOCATION
MONITORING WELL LOCATION
0 SCALE 100'
1 inch = 100 feet
NOTE:
SAMPLE LOCATIONS ARE FOR ILLUSTRATIVE PURPOSES ONLY.
INDIAN MOUNTAIN
LONG RANGE RADAR STATION
LF05
LANDFILL NO. 2
LOWER CAMP
PROJ. MGR. L.SCHUETTER
ACAD FILE NO. 3_3-5
FIGURE NO. 3.3-4
DRAWN BY HUNTER
PROJ. NO. 05-G-46200
DATE 5/25/94

on current information are shown in Figure 3.3-4. Sample locations will be finalized following the summer 1994 site reconnaissance and the metal-detector survey.

Surface and subsurface samples were collected from each of two locations at LF05 in 1992. The additional field investigations to be conducted in 1994 will concentrate on characterizing possible migration of wastes away from LF05. Surface water and sediment samples will be collected for laboratory analyses from each of the two seeps and from the ponded water area identified at LF05 because these may represent contaminated water emanating from the landfill. A boring will be drilled to the east of the active landfill area to determine whether contaminants are migrating laterally in the subsurface in this area. One subsurface soil sample for laboratory analyses will be collected at the water table from this boring, and a groundwater sample will be collected for rapid turn-around (five day) analysis. Following review of the metal-detector survey results and receipt of the rapid turnaround groundwater analyses, a location will be selected for a monitoring well to the east (downgradient) of LF05. One groundwater sample will be collected from the well for complete laboratory analyses.

No screening samples will be collected at LF05. All of the samples collected will be submitted to the laboratory for laboratory analyses. All samples will be analyzed for DRO/GRO, VOC, SVOC, pesticides/PCBs, and ICP metals. Water samples will also be analyzed for GFAA metals, mercury by the cold-vapor method, and for common anions. Soil samples will also be analyzed for RRO.

3.3.1.5 Source Area LF06

Source area LF06 includes waste accumulation area no. 4, landfill no. 3, and landfill no. 4. All three of these areas are located south of the runway and north of Utopia Creek close to one another.

Waste accumulation area no. 4 was used in the 1950s and 1960s as a drum storage area for fuels or wastes. The actual dimensions of the area are unknown. No evidence of the waste accumulation area was seen during the May 1994 site visit. It is possible that areas of drum storage and disposal adjacent to the runway have been buried or removed during grading and maintenance activities along the runway. Landfill no. 3 is an area of approximately 0.2 acre that was used from 1978 to 1980 for disposal of scrap metal, drums, wood, and other debris. W-C (1993) reported debris exposed at the surface in 1992, although they reported no surface staining. Landfill no. 4 is located immediately east of landfill no. 3 and is also about 0.2 acre in area. This landfill was used in the 1970s for burial of 50 to 100 drums from waste accumulation area no. 4. Content of the drums is unknown. Both landfill no. 3 and no. 4 are generally at grade on the northern sides but are contained by berms on their southern sides. A small stream flows between the two landfills toward Utopia Creek. About 400 feet downstream from the landfills, the stream flows through a marshy area approximately 100 feet upstream from Utopia Creek. A pit containing two metal tanks is located on the southern edge of Landfill No. 3, just uphill (north) from the berm. Ponded water covered the eastern third of landfill no. 3 in May 1994. At landfill no. 4, a seep was located uphill of the berm and an area of ponded water was located just downhill of the berm, downgradient of the seep. An area of stained soil was also observed at the western end of landfill no. 4 in May 1994. Much of the area downhill from the landfill berms contained drums and metal debris visible at the surface. Surface and subsurface soil samples have been collected by W-C from all three areas in LF06.

Site investigations at LF06 will include screening analyses of groundwater and subsurface soils; and laboratory analyses of soil, surface water, sediment, and groundwater samples. Proposed sample locations based on current information are shown in Figures 3.3-3 and 3.3-5. Sample locations will be finalized following the summer 1994 site reconnaissance.

Two soil-boring locations will be selected. Two soil samples will be collected from each borehole and screened for petroleum hydrocarbon using field test kits. The soil samples selected for screening will be determined in the field using visual, olfactory, and HNu evidence. Based on the field-screening data, one soil sample from each borehole will be selected for laboratory analyses. One groundwater sample will also be collected from each borehole for field screening and laboratory analyses.

At landfill no. 3, shallow subsurface soil samples will be collected for petroleum hydrocarbon screening at four locations. A sample from the location with the highest petroleum hydrocarbon screening value will also be collected for laboratory analyses. Surface water and sediment samples for laboratory analyses will be collected from three locations: the ponded area at the eastern third of the landfill, the pit containing the metal tanks, and the marshy area 400 feet downstream.

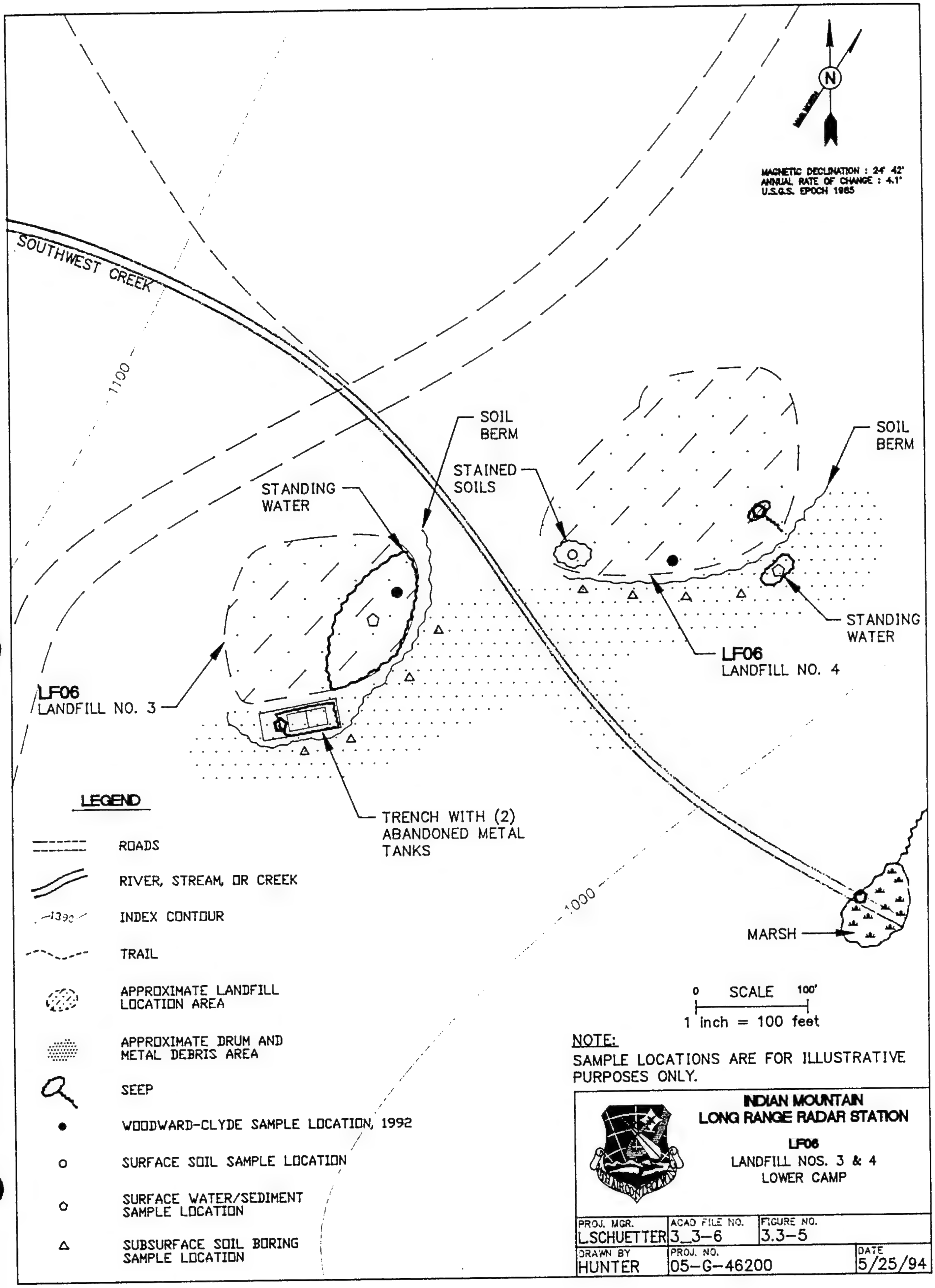
At landfill no. 4, investigations will begin with a soil-gas survey at five locations on the downhill side of the berm. Based on the soil-gas results, shallow subsurface soil samples will be collected for petroleum hydrocarbon screening at four locations. A sample from the location with the highest petroleum hydrocarbon screening value will also be collected for laboratory analyses. Surface water and sediment samples for laboratory analyses will be collected from two locations: the seep near the eastern end of the landfill and the ponded water located downgradient of the berm near the seep. One surface soil sample will also be collected for laboratory analyses from the stained soil area on the western end of the landfill.

Shallow subsurface soil samples will be collected for screening analyses from several locations in LF06. These samples will be screened for petroleum hydrocarbon using field immunoassay test kits. Surface soil, shallow subsurface soil, and sediment samples collected for laboratory analyses will be analyzed for DRO/GRO/RRO, VOC, SVOC, pesticides/PCBs, and ICP metals. Water samples will be analyzed for DRO/GRO, VOC, SVOC, pesticides/PCBs, ICP metals, GFAA metals, mercury by the cold-vapor method, and common anions. However, the groundwater and subsurface soil samples collected at waste accumulation area no. 4 will not be analyzed for SVOCs because the principal contaminants expected in this area are VOCs from the previous drum contents. Also, the surface water samples will be analyzed only for arsenic using GFAA; no other GFAA analyses will be performed.

3.3.1.6 <u>Source Area SD07 (Runway Oiling)</u>

Source area SD07 generally includes the runway and road areas where waste oils and solvents had been applied for dust suppression (Figure 3.3-1). The runway area is discussed in this section. The road between Upper Camp and Lower Camp is discussed in Section 3.4.1.2.

Waste oils and shop wastes including solvents and ethylene glycol were routinely applied to the runway for dust suppression from the 1950s until 1984. VOCs were detected at low, estimated levels in soil samples collected adjacent to the runway in 1992.



N
MAGNETIC DECLINATION : 24° 42'
ANNUAL RATE OF CHANGE : 4.1'
U.S.G.S. EPOCH 1985
SOUTHWEST CREEK
1100
SOIL BERM
STAINED SOILS
STANDING WATER
SOIL BERM
STANDING WATER
LF06
LANDFILL NO. 4
LF06
LANDFILL NO. 3
TRENCH WITH (2) ABANDONED METAL TANKS
1000
MARSH
LEGEND
ROADS
RIVER, STREAM, OR CREEK
1390
INDEX CONTOUR
TRAIL
APPROXIMATE LANDFILL LOCATION AREA
APPROXIMATE DRUM AND METAL DEBRIS AREA
SEEP
WOODWARD-CLYDE SAMPLE LOCATION, 1992
SURFACE SOIL SAMPLE LOCATION
SURFACE WATER/SEDIMENT SAMPLE LOCATION
SUBSURFACE SOIL BORING SAMPLE LOCATION
0 SCALE 100'
1 inch = 100 feet
NOTE:
SAMPLE LOCATIONS ARE FOR ILLUSTRATIVE PURPOSES ONLY.
INDIAN MOUNTAIN
LONG RANGE RADAR STATION
LF06
LANDFILL NOS. 3 & 4
LOWER CAMP
PROJ. MGR. L.SCHUETTER
ACAD FILE NO. 3_3-6
FIGURE NO. 3.3-5
DRAWN BY HUNTER
PROJ. NO. 05-G-46200
DATE 5/25/94

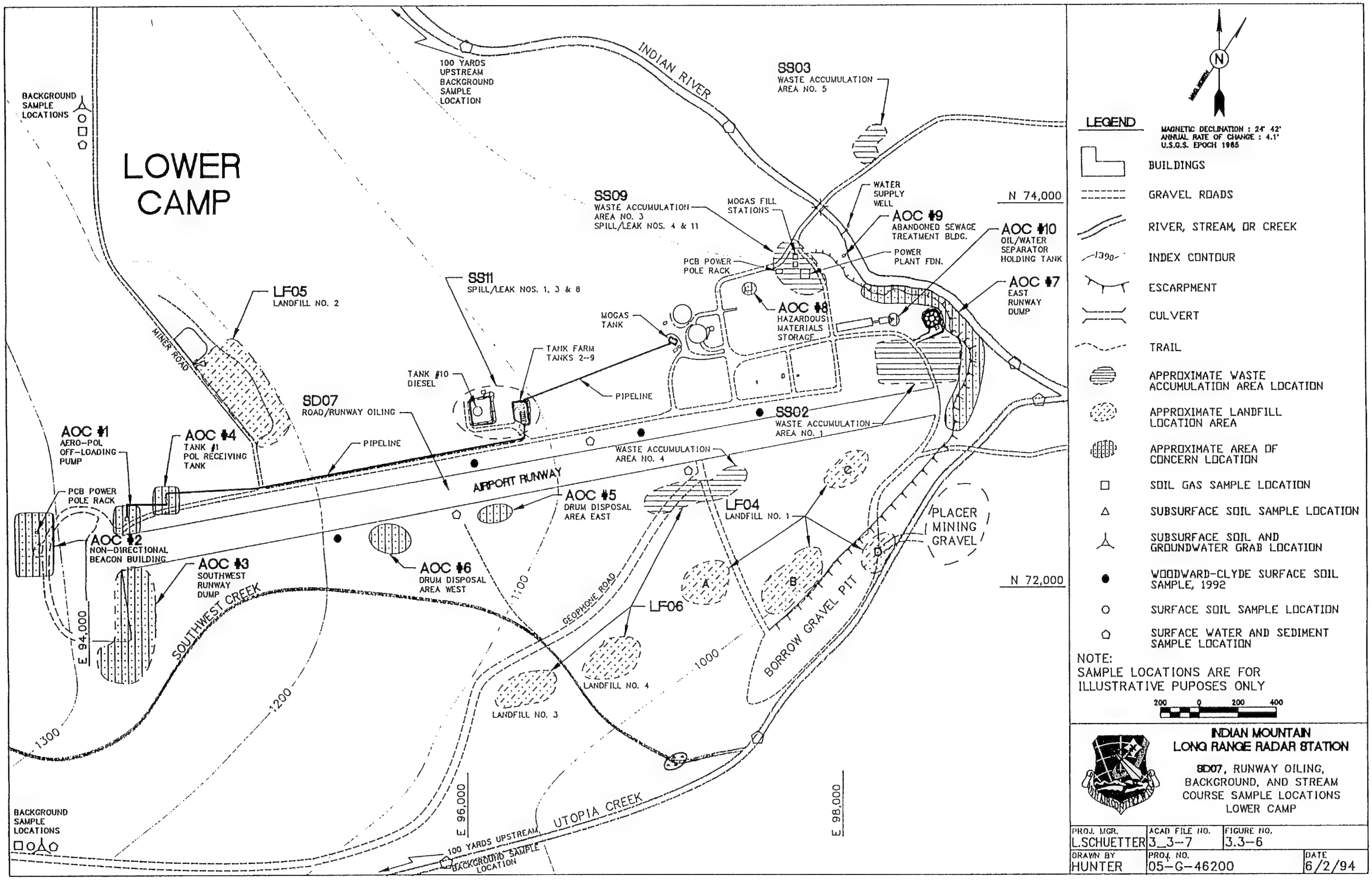
Because of the elapsed time since the last application of waste to the runway and because of the frequent grading and runway maintenance activities since that time, direct sampling of the runway will not be conducted. However, areas of seeps or accumulated runoff in ditches adjacent to the runway will be sampled. Appropriate seeps or water accumulations will be identified during the summer 1994 site reconnaissance. For planning purposes, we have assumed that three sampling locations will be identified, one on the north side of the runway and two on the south side. Tentative locations, based on current information, are shown in Figure 3.3-6. A water sample and a sediment sample will be collected from each location and submitted for laboratory analyses. The samples will be analyzed for DRO/GRO, VOC, SVOC, pesticides/PCBs, and ICP metals. The water samples will also be analyzed for lead using GFAA and common anions. Sediment samples will also be analyzed for RRO.

3.3.1.7 Source Area SS09

Source area SS09 includes waste accumulation area no. 3 and spill/leak nos. 4 and 11, located just northeast of the industrial and residential domes (Figure 3.3-1). This area includes the former power plant and two mogas fill stations. Only the foundation of the power plant was evident during the site visit. The concrete mogas pad contained an empty tank and was covered with standing water in May 1994. An area of stained soil was located just north of the pad, at the end of an apparent outfall pipe. A seep was located just north of the area of stained soil and just south of the second mogas pad. Two power poles located along the western edge of SS09 are connected by what appears to be a former transformer rack. The area immediately southwest of SS09 includes a burial area for a large number of buildings that were demolished in the late 1970s. The old incinerator building, now used for hazardous materials storage (AOC no. 8), is located about 300 feet west-southwest of SS09.

Investigations at SS09 will include collection of surface and subsurface soil samples for PCB screening, installation of borings for collection of subsurface soil and groundwater samples for field screening and laboratory analyses, surface soil sampling for laboratory analyses, collection of surface water and sediment samples for laboratory analyses, and installation of a monitoring well and collection of a groundwater sample for laboratory analyses. Tentative sample locations are shown in Figure 3.3-7. The sample locations will be finalized following the summer 1994 site reconnaissance and after collection of field-screening samples.

Soil samples for PCB screening by immunoassay test kits will be collected beneath the apparent transformer rack at the western side of SS09. Eight surface soil and five subsurface soil samples will be collected. Based on the screening results, one surface soil and one shallow subsurface (0.5 to 1 foot) soil sample will be collected for full laboratory analyses. At the seep location between the two mogas pads, one surface water, one sediment, and one subsurface soil (about three feet in depth) sample will be collected for laboratory analyses. The analytical results for these samples will be used to assess the presence of contamination in this area where stained soil and a seep have been observed. One surface water and one sediment sample will also be collected for laboratory analyses from the swampy surface water catchment area located downgradient to the north-northwest of SS09. These samples are designed to investigate the possible transport of contaminants away from SS09 toward Indian River.


LOWER CAMP
BACKGROUND SAMPLE LOCATIONS
100 YARDS UPSTREAM BACKGROUND SAMPLE LOCATION
INDIAN RIVER
SS03
WASTE ACCUMULATION AREA NO. 5
SS09
WASTE ACCUMULATION AREA NO. 3
SPILL/LEAK NOS. 4 & 11
MOGAS FILL STATIONS
WATER SUPPLY WELL
AOC #9
ABANDONED SEWAGE TREATMENT BLDG.
POWER PLANT FDN.
AOC #10
OIL/WATER SEPARATOR HOLDING TANK
AOC #7
EAST RUNWAY DUMP
N 74,000
PCB POWER POLE RACK
AOC #8
HAZARDOUS MATERIALS STORAGE
MOGAS TANK
SS11
SPILL/LEAK NOS. 1, 3 & 8
LF05
LANDFILL NO. 2
MINER ROAD
TANK FARM TANKS 2–9
TANK #10 DIESEL
PIPELINE
SD07
ROAD/RUNWAY OILING
SS02
WASTE ACCUMULATION AREA NO. 1
WASTE ACCUMULATION AREA NO. 4
AOC #1
AERO-POL OFF-LOADING PUMP
AOC #4
TANK #1 POL RECEIVING TANK
AIRPORT RUNWAY
AOC #5
DRUM DISPOSAL AREA EAST
LF04
LANDFILL NO. 1
PLACER MINING GRAVEL
PCB POWER POLE RACK
AOC #2
NON-DIRECTIONAL BEACON BUILDING
AOC #6
DRUM DISPOSAL AREA WEST
AOC #3
SOUTHWEST RUNWAY DUMP
SOUTHWEST CREEK
GEOPHONE ROAD
LF06
BORROW GRAVEL PIT
N 72,000
E 94,000
LANDFILL NO. 4
LANDFILL NO. 3
1000
1100
1200
1300
E 96,000
E 98,000
UTOPIA CREEK
100 YARDS UPSTREAM BACKGROUND SAMPLE LOCATION
LEGEND
MAGNETIC DECLINATION : 24° 42'
ANNUAL RATE OF CHANGE : 4.1'
U.S.G.S. EPOCH 1965
BUILDINGS
GRAVEL ROADS
RIVER, STREAM, OR CREEK
1390
INDEX CONTOUR
ESCARPMENT
CULVERT
TRAIL
APPROXIMATE WASTE ACCUMULATION AREA LOCATION
APPROXIMATE LANDFILL LOCATION AREA
APPROXIMATE AREA OF CONCERN LOCATION
SOIL GAS SAMPLE LOCATION
SUBSURFACE SOIL SAMPLE LOCATION
SUBSURFACE SOIL AND GROUNDWATER GRAB LOCATION
WOODWARD-CLYDE SURFACE SOIL SAMPLE, 1992
SURFACE SOIL SAMPLE LOCATION
SURFACE WATER AND SEDIMENT SAMPLE LOCATION
NOTE:
SAMPLE LOCATIONS ARE FOR ILLUSTRATIVE PUPOSES ONLY
200 0 200 400
INDIAN MOUNTAIN
LONG RANGE RADAR STATION
SD07, RUNWAY OILING, BACKGROUND, AND STREAM COURSE SAMPLE LOCATIONS LOWER CAMP
PROJ. MGR. L.SCHUETTER
ACAD FILE NO. 3_3–7
FIGURE NO. 3.3–6
DRAWN BY HUNTER
PROJ. NO. 05–G–46200
DATE 6/2/94

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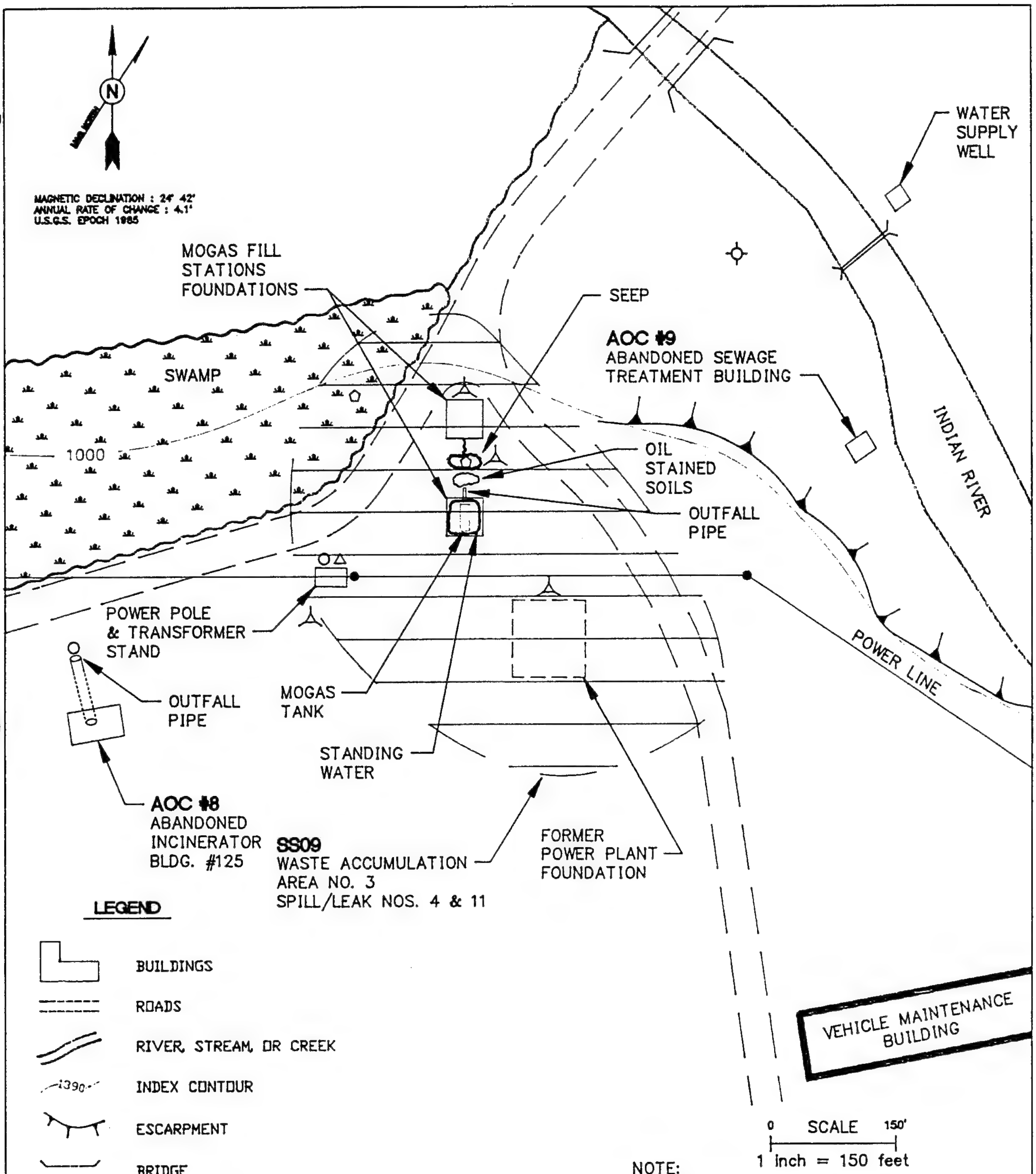


NOTE:
SAMPLE LOCATIONS ARE FOR ILLUSTRATIVE PURPOSES ONLY.

INDIAN MOUNTAIN LONG RANGE RADAR STATION

SS09 WASTE ACCUMULATION AREA NO. 3, SPILL/LEAK NOS. 4 & 11 AREA OF CONCERN NOS. 8 & 9 LOWER CAMP

PROJ. MGR.	ACAD FILE NO.	FIGURE NO.	
L.SCHUETTER	3_3-8	3.3-7	
DRAWN BY	PROJ. NO.		DATE
HUNTER	05-G-46200		5/25/94

Four borings will also be drilled in the general area of SS09. At each borehole, one subsurface soil sample and one groundwater grab sample will be collected for field screening and laboratory analyses to assess possible subsurface contaminant transport away from areas within SS09. One boring will be drilled to the water table or to refusal downgradient of each of the two mogas pads. One borehole will be drilled downgradient of the power plant foundation, and the fourth borehole will be drilled in the area between AOC no. 8 and the mogas pads. This borehole will be designed to assess possible subsurface contamination originating from the old building burial area southwest of SS09.

One groundwater monitoring well will be constructed downgradient of SS09 and adjacent to Indian River. A groundwater sample will be collected from this well to assess possible transport of contaminants from SS09 to Indian River through the shallow groundwater system.

Field-screening soil samples will be analyzed for PCBs and groundwater samples for TPH using field immunoassay test kits. Most other samples will be analyzed in the laboratory for DRO/GRO, VOC, SVOC, pesticides/PCBs, and ICP metals. Soil and sediment samples will also be analyzed for RRO. Water samples will also be analyzed for GFAA metals, mercury by the cold-vapor method, and common anions. Exceptions to this general approach are outlined below.

Groundwater samples from the borings downgradient of the mogas pad will be analyzed for ICP metals and GFAA lead rather than all GFAA metals.

- The groundwater sample from the boring near the power plant foundation will be analyzed for cold vapor mercury in addition to the ICP metals.
- Surface water samples from the seep area between the two mogas pads will be analyzed only for GFAA lead rather than all GFAA metals.
- The surface water and sediment samples collected from the swampy catchment area will not be analyzed for PCBs because PCBs are relatively immobile and no surface water pathway to the catchment area is defined.

3.3.1.8 Source Area SS11

Source area SS11 consists of spill/leak nos. 1, 3, and 8, located at the POL tank farm north of the runway and about halfway down the length of the runway. Three diesel fuel leaks of 3,500 gallons, 29,000 gallons, and 33,000 gallons occurred between 1973 and 1977. No samples have been collected from SS11. During the May 1994 site visit, a drain was noted exiting the northeast corner of the bermed area around Tanks 2 through 9, and a second drain was noted exiting the north side of the bermed area around Tank 10. The drains apparently discharge directly to the ground surface. In addition, a seep that discharged to a drainage flowing to the northeast was observed north of SS11.

The intent of the soil-gas investigation is to determine the lateral and downgradient extent of potential contamination. Since no previous studies have been conducted at SS11, investigations at this source area will begin with a comprehensive soil-gas survey to help identify the lateral extent of subsurface fuel contamination. Five soil-gas probes will be located between the deactivated Tank 10 and the bulk storage tank farm (Tanks 2 through 9). Thirty additional soil-gas probes will be located downgradient of the tank farm area along three arcs with a grid spacing of 10 feet

along each arc. The arcs will be spaced about 50 feet apart radially away from the northeast corner of the tank farm berm. Exploratory soil borings will then be advanced on the downgradient sides of the bermed areas surrounding the tanks, at locations based on the soil-gas results. If contamination is detected based on visual, olfactory, or HNu evidence, borings will be moved further downgradient to determine the downgradient extent of fuel contamination. If no evidence of contamination is apparent based on visual, olfactory, or HNu indications, soil samples will be collected from the borings and screened for petroleum hydrocarbons using field test kits in order to determine the downgradient extent of contamination. Subsurface soil samples will be collected for laboratory analyses from three borings at the apparent downgradient extent of contamination. An additional borehole will be drilled between Tank 10 and the tank farm and a soil sample will be collected for laboratory analyses. One soil sample from SS11 will be collected for geotechnical analyses.

Additional sampling will take place in the area of the seep north of SS11. A surface water and a sediment sample will be collected from the seep area for laboratory analyses. In addition, a monitoring well will be installed downgradient of the Tank 10 bermed area, in the vicinity of the seep. A groundwater sample will be collected for field screening and laboratory analyses from the well. Depending on the results of the soil-gas, soil-screening, and groundwater-screening data, a second monitoring well may be required further downgradient to assess potential downgradient migration of contamination. Tentative sample locations are shown in Figure 3.3-8. The sample locations will be finalized following the summer 1994 site reconnaissance and after collection and analysis of soil-gas samples.

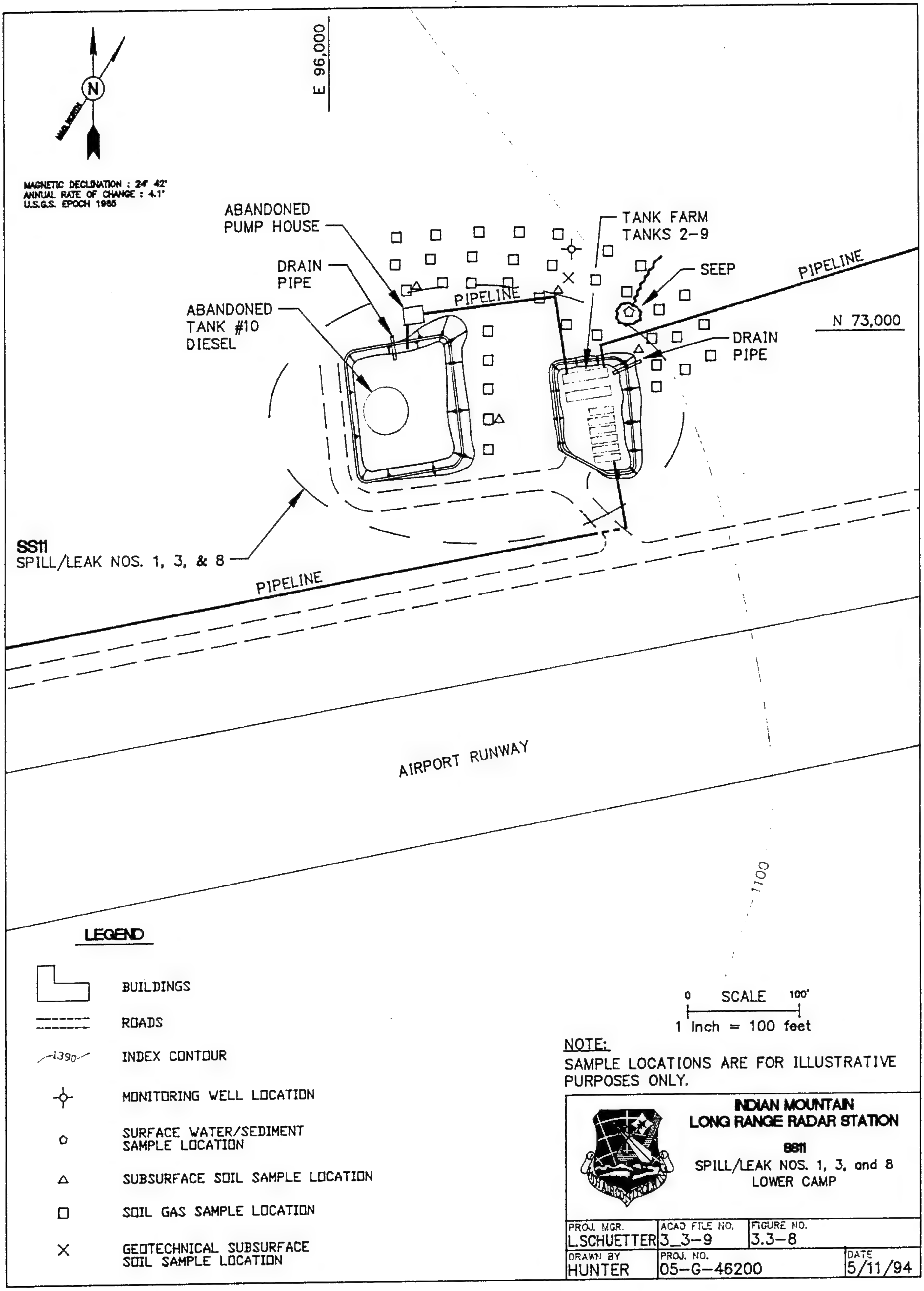
Soil and groundwater samples collected for field screening will be analyzed for petroleum hydrocarbon using immunoassay test kits. Soil and sediment samples collected for laboratory analyses will be analyzed for DRO/GRO/RRO, VOC, and SVOC because the only suspected contaminants at SS11 are diesel fuels. Surface water and groundwater samples will be analyzed for DRO/GRO, VOC, SVOC, ICP metals, and common anions; the metals and anions analyses will be used primarily for general water typing to help assess groundwater/surface water interactions. The soil sample collected for geotechnical analyses will be analyzed for grain-size distribution, moisture content, specific gravity, vertical permeability, organic carbon content, and cation exchange capacity.

3.3.2 Areas of Concern

During the May 1994 site visit, areas not currently designated as IRP source areas were evaluated to determine the need for potential contaminant characterization. Ten AOCs were identified. Field survey and sampling investigations are proposed that have been specifically designed to determine the presence and extent of potential contamination. The following sections provide information regarding the location, known use of each AOC, objectives and rationale for sampling, survey type, data collection, sampling locations, field screening analysis, and laboratory analyses.

3.3.2.1 <u>Area of Concern No. 1 - Aero Petroleum, Oils, and Lubricants Offloading Pump</u>

AOC no. 1 is located at the northwest end of the runway. The Aero-POL offloading pump is a portable pump used to transfer fuels from aircraft to station storage tanks.



E 96,000
N
MAGNETIC DECLINATION : 24° 42'
ANNUAL RATE OF CHANGE : 4.1'
U.S.G.S. EPOCH 1985
ABANDONED PUMP HOUSE
DRAIN PIPE
ABANDONED TANK #10 DIESEL
PIPELINE
TANK FARM TANKS 2-9
SEEP
PIPELINE
N 73,000
DRAIN PIPE
SS11
SPILL/LEAK NOS. 1, 3, & 8
PIPELINE
AIRPORT RUNWAY
1100
LEGEND
BUILDINGS
ROADS
1390
INDEX CONTOUR
MONITORING WELL LOCATION
SURFACE WATER/SEDIMENT SAMPLE LOCATION
SUBSURFACE SOIL SAMPLE LOCATION
SOIL GAS SAMPLE LOCATION
GEOTECHNICAL SUBSURFACE SOIL SAMPLE LOCATION
0 SCALE 100'
1 Inch = 100 feet
NOTE:
SAMPLE LOCATIONS ARE FOR ILLUSTRATIVE PURPOSES ONLY.
INDIAN MOUNTAIN
LONG RANGE RADAR STATION
SS11
SPILL/LEAK NOS. 1, 3, and 8
LOWER CAMP
PROJ. MGR. L.SCHUETTER
ACAD FILE NO. 3_3-9
FIGURE NO. 3.3-8
DRAWN BY HUNTER
PROJ. NO. 05-G-46200
DATE 5/11/94

The area around the pump is free of vegetation and is not bermed or lined. The ground slopes to the south. Approximately 25 feet from the pump area is an ephemeral ditch that continues along the margin of the runway frontage road.

During the site visit, stained soils were observed near the pump. To determine the presence and extent of POL-related contaminants in soils at this area, screening and laboratory analyses will be performed. Surface water and sediment will be collected from the drainage downgradient of the pump to determine the presence of POL-related contaminants and the potential for downstream migration. Figure 3.3-9 depicts the location of sampling points at and near the offloading pump.

The investigation will include the collection and analysis of surface soil and shallow subsurface soil samples (approximately 1 to 3 feet below ground surface) for screening analysis and for surface soil, subsurface soil, surface water, and sediment for laboratory analysis. Based on field observations, it is estimated that four surface soil and four shallow subsurface soil samples will be collected for screening level analysis. It is estimated that two surface soil and one shallow subsurface soil sample will be collected for laboratory analysis. One surface water and one sediment sample will also be collected from the drainage for laboratory analysis.

The screening level analysis will include field test kit determinations of petroleum hydrocarbon contamination. The laboratory analysis for surface soil, subsurface soil, surface water, and sediment will include DRO/GRO, VOC, and SVOC. Soil and sediment samples will also be analyzed for RRO. Tables 3.2-1, 3.2-3, 3.2-6, and 3.2-7 present the number of samples and analytical methods proposed for samples collected at this AOC.

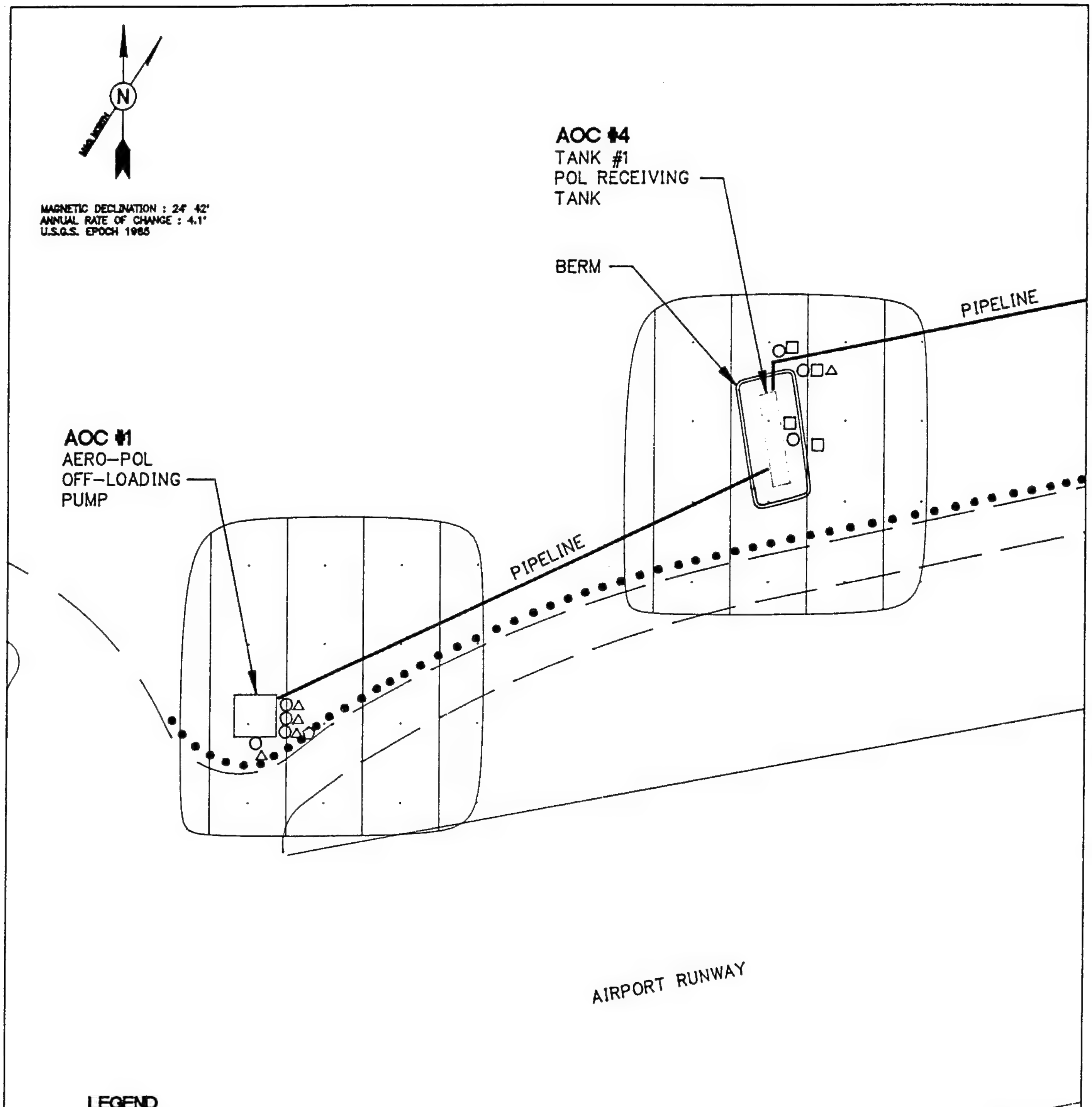
Depending on the extent of contamination, depth of contamination, and degree of weathering of any hydrocarbons, this AOC may become an IRP site if contamination appears to be from historic use of the area, or may be referred to the compliance program if contamination appears to be from current activities.

3.3.2.2 Area of Concern No. 2 - Nondirectional Beacon Building

The nondirectional beacon (NDB) building is located approximately 200 feet west of the west end of the runway. The NDB building is located on an east dipping slope. According to station personnel, the NDB building was used as the runway control tower during early station activities. It is currently empty with the exception of the unmanned NDB which provides location information for aircraft. A power pole with a transformer stand is located approximately 30 feet north of the building.

In order to determine the presence of contamination associated with the transformer and possible transformer maintenance at this AOC, soils located beneath the transformer stand and soils located near what appears to be a utility door on the building will be investigated. Surface soils and shallow subsurface soils (approximately 0.5 to 1 feet below ground surface) at both locations will be analyzed to determine the areal and vertical extent of contamination. Figure 3.3-10 depicts the location of planned soil sample collection.

The investigation will include screening and laboratory analyses. Screening level sampling will initially be performed beneath the transformer stand and near the utility door. If contamination is detected in the samples collected, additional samples will be collected in a radial pattern to assess the areal extent of contamination. In



LEGEND

- BUILDINGS
- ROADS
- APPROXIMATE AREA OF CONCERN LOCATION
- EPHEMERAL SURFACE DRAINAGE
- ○ SURFACE SOIL SAMPLE LOCATION
- △ SUBSURFACE SOIL SAMPLE LOCATION
- □ SOIL GAS SAMPLE LOCATION
- ⬠ SURFACE WATER AND SEDIMENT SAMPLE LOCATION

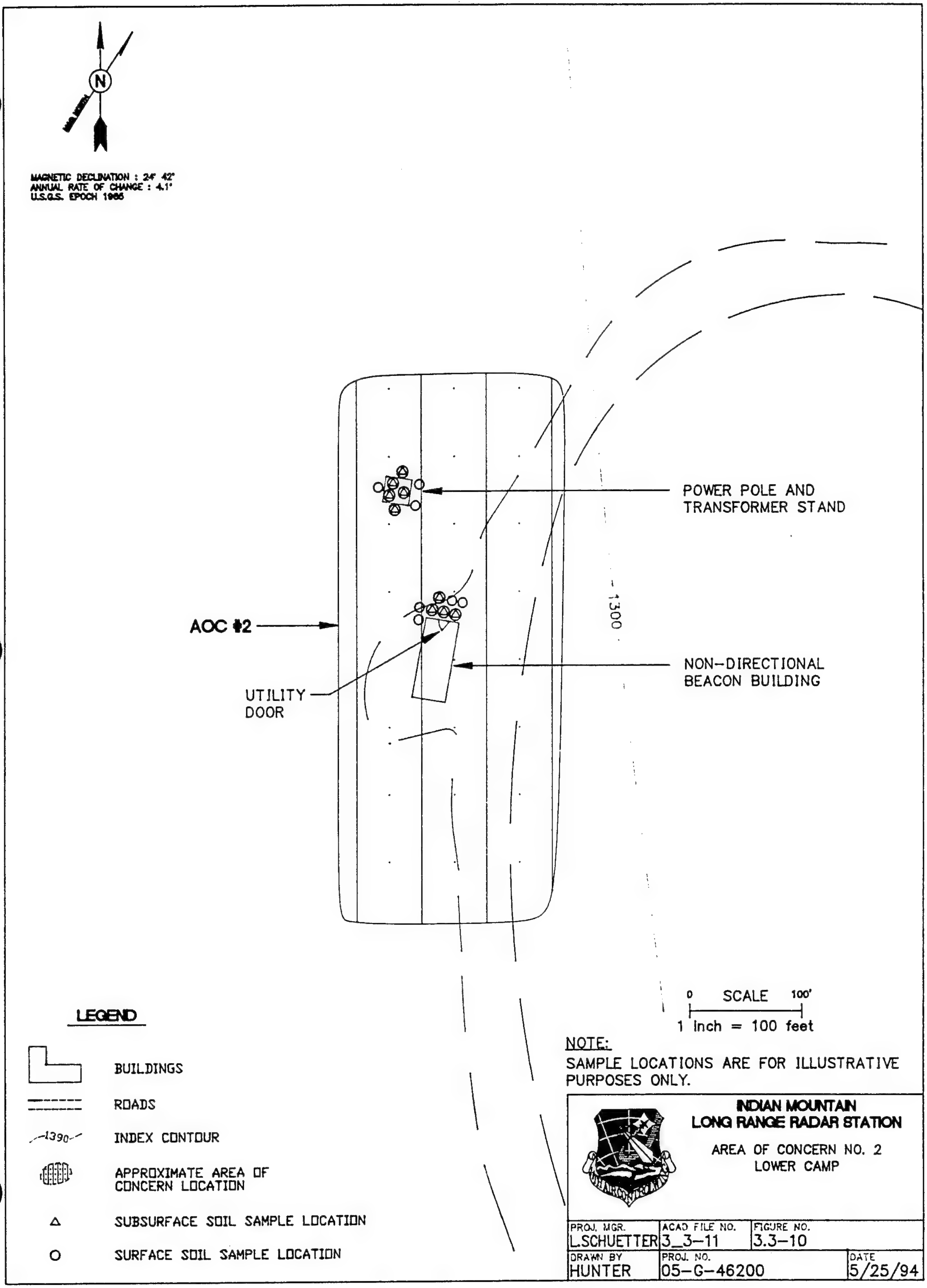
0 SCALE 200'
1 Inch = 200 feet

NOTE:
SAMPLE LOCATIONS ARE FOR ILLUSTRATIVE PURPOSES ONLY.

INDIAN MOUNTAIN LONG RANGE RADAR STATION

AREA OF CONCERN
NOS. 1 & 4
LOWER CAMP

PROJ. MGR.	ACAD FILE NO.	FIGURE NO.	
L.SCHUETTER	3_3-10	3.3-9	
DRAWN BY	PROJ. NO.		DATE
HUNTER	05-G-46200		5/25/94


N
MAGNETIC DECLINATION : 24° 42'
ANNUAL RATE OF CHANGE : 4.1'
POWER POLE AND
TRANSFORMER STAND
1300
AOC #2
NON-DIRECTIONAL
BEACON BUILDING
UTILITY
DOOR
0 SCALE 100'
1 inch = 100 feet
NOTE:
SAMPLE LOCATIONS ARE FOR ILLUSTRATIVE PURPOSES ONLY.
LEGEND
BUILDINGS
ROADS
1390
INDEX CONTOUR
APPROXIMATE AREA OF CONCERN LOCATION
SUBSURFACE SOIL SAMPLE LOCATION
SURFACE SOIL SAMPLE LOCATION
INDIAN MOUNTAIN
LONG RANGE RADAR STATION
AREA OF CONCERN NO. 2
LOWER CAMP
PROJ. MGR. L.SCHUETTER
ACAD FILE NO. 3_3-11
FIGURE NO. 3.3-10
DRAWN BY HUNTER
PROJ. NO. 05-G-46200
DATE 5/25/94

addition, where contamination is detected in surface soil samples, shallow subsurface soils will be screened to determine the vertical extent of contamination.

Based on field observations, it is estimated that eight surface and five shallow subsurface soils will be collected for screening analysis below the transformer stand. Eight surface soil and four shallow subsurface soil samples will be collected for screening analysis near the building utility door. The screening analysis includes PCBs and petroleum hydrocarbons. For confirmational purposes, laboratory samples will be collected for laboratory analysis. It is estimated that one surface soil sample and one subsurface soil sample will be collected from each area. Laboratory analysis includes DRO/GRO/RRO, pesticides/PCBs, and SVOCs. Tables 3.2-1, 3.2-3, and 3.2-4 present the number of samples and methods proposed for samples collected at this AOC.

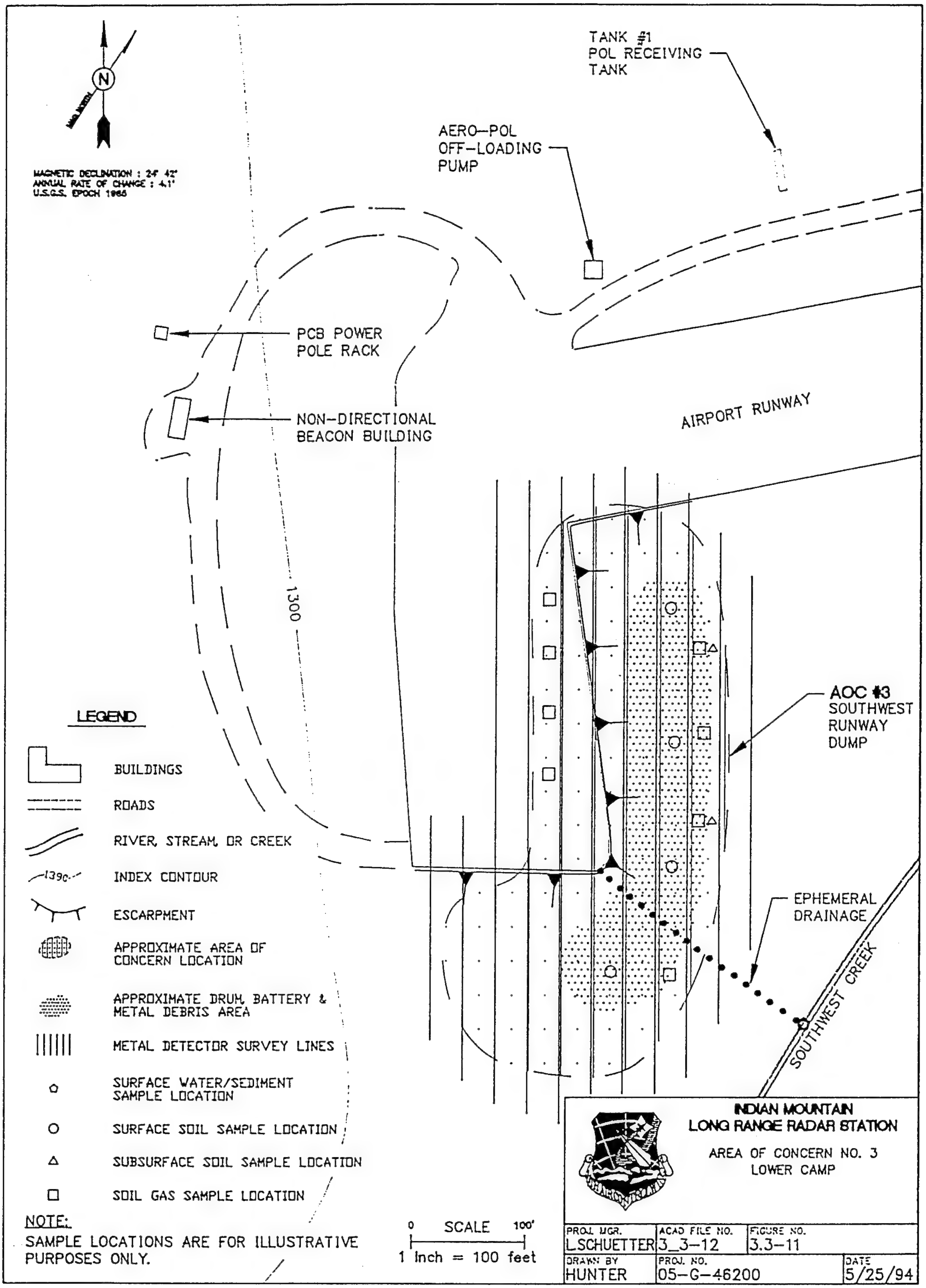
3.3.2.3 Area of Concern No. 3 - Southwest Runway Area

This AOC is located along the edge of the southwest runway staging area. The staging area appears to have been built above natural grade. This has created an escarpment from the staging area to the vegetated areas below. Miscellaneous debris was observed in the escarpment and at the base of the escarpment during the May 1994 site visit. The debris included empty drums, batteries, and other metallic waste. The debris appears to be limited to the near escarpment area, encompassing approximately one-quarter acre. An ephemeral drainage was observed flowing from the southwest corner of the staging area to the base of the escarpment and into the Southwest Creek.

To determine the extent of material possibly buried in the runway staging area, a metal-detector survey will be performed. To characterize potential subsurface contamination, a soil-gas survey will be performed at the base of the escarpment and on the staging area. At the base of the escarpment, shallow subsurface soil samples (approximately 1 to 3 feet below ground surface) will be collected to determine the presence of contamination. To assess contaminant migration to Southwest Creek, surface water and sediment will be collected and analyzed. Figure 3.3-11 depicts the locations of proposed sampling points.

The investigation will be initiated with a metal-detector survey along the top of the escarpment and on the runway staging area. This will provide an indication of the extent of buried metallic debris. The information derived during the metal-detector survey may aid in the placement of soil-gas points. Soil-gas locations on the staging area will target those areas where large concentrations of metallic debris are identified. At the base of the escarpment, soil-gas points will be located downgradient of areas suspected of formerly containing drummed waste. Field screening samples will be collected in surface soils at the base of the escarpment to determine the presence of contamination. If contamination is detected by screening analyses, shallow subsurface soils will be collected for screening analysis. The drainage leading to Southwest Creek will also be characterized as a possible contaminant migration pathway. Laboratory analyses will be conducted on surface water and sediment collected at the point where the staging area drainage enters Southwest Creek.

Based on field observation, four soil-gas locations on the staging area and four locations below the escarpment are planned. Four surface soil and two shallow subsurface soil samples have been targeted for screening characterization using PCB and petroleum hydrocarbon test kits. It is assumed that for laboratory


N
MAGNETIC DECLINATION : 24° 42'
ANNUAL RATE OF CHANGE : 4.1'
U.S.G.S. EPOCH 1965
TANK #1
POL RECEIVING
TANK
AERO-POL
OFF-LOADING
PUMP
PCB POWER
POLE RACK
NON-DIRECTIONAL
BEACON BUILDING
AIRPORT RUNWAY
1300
AOC #3
SOUTHWEST
RUNWAY
DUMP
EPHEMERAL
DRAINAGE
SOUTHWEST CREEK
LEGEND
BUILDINGS
ROADS
RIVER, STREAM, OR CREEK
1390
INDEX CONTOUR
ESCARPMENT
APPROXIMATE AREA OF CONCERN LOCATION
APPROXIMATE DRUM, BATTERY & METAL DEBRIS AREA
METAL DETECTOR SURVEY LINES
SURFACE WATER/SEDIMENT SAMPLE LOCATION
SURFACE SOIL SAMPLE LOCATION
SUBSURFACE SOIL SAMPLE LOCATION
SOIL GAS SAMPLE LOCATION
NOTE:
SAMPLE LOCATIONS ARE FOR ILLUSTRATIVE PURPOSES ONLY.
0 SCALE 100'
1 inch = 100 feet
INDIAN MOUNTAIN
LONG RANGE RADAR STATION
AREA OF CONCERN NO. 3
LOWER CAMP
PROJ. MGR.
L.SCHUETTER
ACAD FILE NO.
3_3-12
FIGURE NO.
3.3-11
DRAWN BY
HUNTER
PROJ. NO.
05-G-46200
DATE
5/25/94

analyses, two surface soil samples and one shallow subsurface soil sample will be collected. One surface water and one sediment sample will be collected for laboratory analyses. The laboratory analyses for surface soil, subsurface soil, and sediment include DRO/GRO/RRO, VOC, SVOC, pesticides/PCBs, and ICP metals. The analysis of surface water includes the parameters listed, GFAA metals, mercury following the cold-vapor method, and common anions. Tables 3.2-1, 3.2-3, 3.2-4, 3.2-6, and 3.2-7 present the number of samples and the analytical methods proposed for samples collected at this AOC.

3.3.2.4 Area of Concern No. 4 - Tank No. 1, Petroleum, Oils, and Lubricants Receiving Tank

The POL receiving tank is located on the north side of the runway, near the western end of the runway. This tank is a 10,000 gallon diesel storage tank used for primary fuel storage. Diesel fuel offloaded at the Aero POL offloading pump (AOC no. 1) is piped to tank no. 1 for subsequent piping to storage tanks located to the east. The area around the tank is bermed; however, a liner was not observed during the May 1994 site visit.

To assess potential past leaks at this AOC, surface and subsurface soils will be investigated. Figure 3.3-9 depicts the locations of the planned sampling points.

The investigation will include a soil-gas survey, field screening of surface and subsurface soils, and the analysis of surface and subsurface soils by laboratory methods. A soil-gas survey will be performed to assess the presence of VOCs in the subsurface. Soil-gas points will be determined in the field and will include areas inside and outside the berm. These locations will target the northeast area of this AOC, which is the inferred downgradient side. These soil-gas data will be used to determine screening level and laboratory sampling locations. It is anticipated that screening and laboratory sampling will be conducted within and outside the bermed area of the AOC.

It is anticipated that soil-gas measurements will be collected at four locations. Based on the soil-gas results and visual observations made during the site reconnaissance, three surface soil samples and one shallow subsurface soil sample (approximately 1 to 3 feet below ground surface) will be collected for petroleum hydrocarbon field screening. In addition, one surface soil and one shallow subsurface soil sample will be collected for laboratory analyses. The laboratory analysis will include DRO/GRO/RRO, VOC, and SVOC. Tables 3.2-1, 3.2-3, and 3.2-4 present the number of samples and analytical methods proposed for samples collected at this AOC.

3.3.2.5 Area of Concern No. 5 - Drum Disposal Area-East

The drum disposal area-east is located approximately 200 feet south of the runway. This area was identified during the site visit in May 1994. The drums are located at the edge of the runway clear zone, at the point where runway clear zone grading and snow removal activities have created a berm adjacent to natural vegetation. Drums were present in the vegetated area and at the edge of the berm. The drums are located in a small (approximately 100 square feet) depression. Snow was observed within this depression. The northern extent of possible buried drums is unknown. Based on field observations, the drums appear to be empty. Drum markings indicate that they contained fuel (diesel) products.

The distribution of potentially buried drums within the runway clear zone will be determined to assess the relative size of the source area. Characterization of potential contamination at and near the drums will be accomplished by collecting surface water (if present at the time of the investigation), sediment, and shallow subsurface soil (approximately 0.5 to 1 feet below ground surface) samples. Figure 3.3-12 presents the location of sample collection at this AOC.

The metal-detector survey will be conducted along the perimeter of the area to determine the presence and extent of buried metallic debris, assumed to be drums at this location. Shallow subsurface soils will be collected at two locations adjacent to the exposed drums and field screened for petroleum hydrocarbons. If contamination is detected in the screening samples, additional shallow subsurface soil screening will be performed. Laboratory samples will also be collected and include surface water, sediment, and shallow subsurface soil to quantify the presence of contamination.

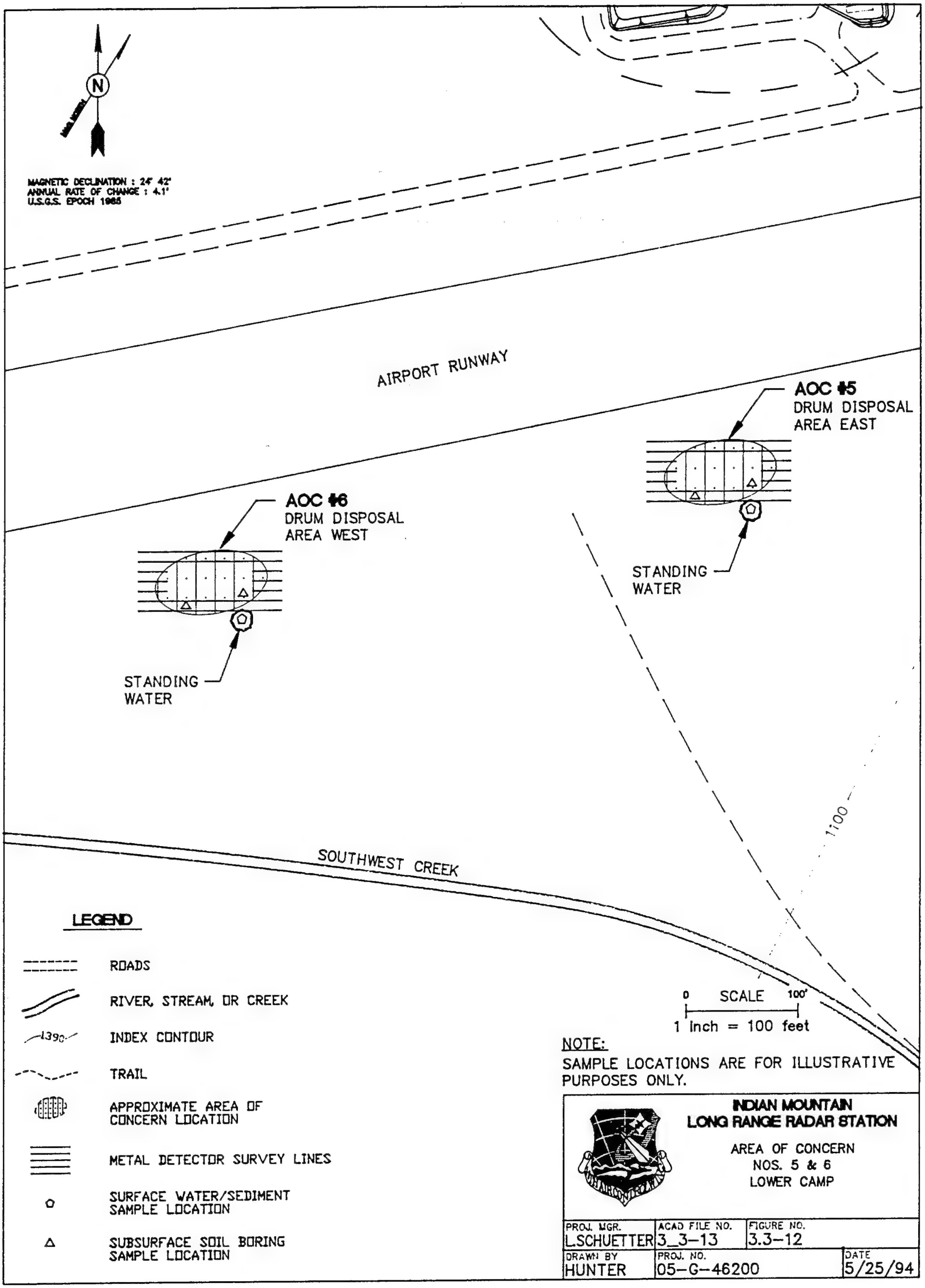
It is assumed that samples collected for laboratory analysis will include one surface water, one sediment, and one shallow subsurface soil sample. The laboratory analyses will include DRO/GRO, VOC, SVOC, and ICP metals. The metal fraction of the surface water sample collected will be analyzed by GFAA methods and for mercury by a cold vapor method in addition to the ICP metals analysis. Sediment and soil samples will also be analyzed for RRO. Tables 3.2-1, 3.2-4, 3.2-6, and 3.2-7 present the number of samples and the analytical methods proposed for sampling at this AOC.

3.3.2.6 Area of Concern No. 6 - Drum Disposal Area-West

The drum disposal area-west is located approximately 220 feet south of the runway. This area was identified during the May 1994 site visit. The drums were located at the edge of the runway clear zone, at the point where runway clear zone grading and snow removal activities have created a berm adjacent to natural vegetation. Drums were present in the vegetated area and at the edge of the berm. The drums were located in a small (approximately 100 square feet) depression. Snow was observed within this depression. The northern extent of possible buried drums is unknown. According to station personnel, the drums contain liquid material. However, an inspection made during the site visit did not confirm the presence of residual liquid material in the drums. The contents of the drums are unknown.

The distribution of potentially buried drums within the runway clear zone will be determined by a metal-detector survey to assess the relative size of the source area. Characterization of potential contamination at and near the drums will be accomplished by collecting surface water (if present at the time of the investigation), sediment, and shallow subsurface soil (approximately 0.5 to 1 foot below ground surface) samples. Figure 3.3-12 depicts the location of sample collection at this AOC.

The metal-detector survey will be conducted along the perimeter of the area to determine the presence and extent of buried drums. The exposed drums will also be investigated to determine if liquid materials are present. Drum thieves will be used to assess the liquid type and relative amount of liquid material present. Shallow subsurface soils will be collected adjacent to the exposed drums for field screening analysis. If contamination is detected in the screening samples, additional shallow subsurface soil screening will be performed. Samples including


N
MAGNETIC DECLINATION : 24° 42'
ANNUAL RATE OF CHANGE : 4.1'
U.S.G.S. EPOCH 1985
AIRPORT RUNWAY
AOC #5
DRUM DISPOSAL
AREA EAST
AOC #6
DRUM DISPOSAL
AREA WEST
STANDING
WATER
STANDING
WATER
1100
SOUTHWEST CREEK
LEGEND
ROADS
RIVER, STREAM, OR CREEK
1390
INDEX CONTOUR
TRAIL
APPROXIMATE AREA OF
CONCERN LOCATION
METAL DETECTOR SURVEY LINES
SURFACE WATER/SEDIMENT
SAMPLE LOCATION
SUBSURFACE SOIL BORING
SAMPLE LOCATION
0 SCALE 100'
1 inch = 100 feet
NOTE:
SAMPLE LOCATIONS ARE FOR ILLUSTRATIVE
PURPOSES ONLY.
INDIAN MOUNTAIN
LONG RANGE RADAR STATION
AREA OF CONCERN
NOS. 5 & 6
LOWER CAMP
PROJ. MGR.
L.SCHUETTER
ACAD FILE NO.
3_3-13
FIGURE NO.
3.3-12
DRAWN BY
HUNTER
PROJ. NO.
05-G-46200
DATE
5/25/94

surface water, sediment, and shallow subsurface soil will also be collected for laboratory analyses to assess the presence and concentrations of contamination.

Based on field observations, two shallow subsurface soil samples will be collected for petroleum hydrocarbon field-screening analysis. It is assumed that samples collected for laboratory analysis will include one surface water, one sediment, and one shallow subsurface soil sample. The laboratory analyses will include DRO/GRO, VOC, SVOC and ICP metals. The metal fraction of the surface water sample collected will be analyzed by GFAA methods and for mercury by a cold vapor method in addition to the ICP metals analysis. Sediment and soil samples will also be analyzed for RRO. Tables 3.2-1, 3.2-4, 3.2-6, and 3.2-7 present the number of samples, and the analytical methods proposed for sampling at this AOC.

3.3.2.7 Area of Concern No. 7 - East Runway Dump

The east runway dump area includes the sewage effluent ponds, the east end of the runway, and the banks of Indian River and Utopia Creek. During the site visit in May 1994, these areas were observed to contain possible buried material. Miscellaneous metallic debris including drums was observed along an escarpment adjacent to the Indian River. A swale at the base of this escarpment within the floodplain of Indian River was observed, and standing water was present at select locations. A lowland floodplain is present at the end of the runway and at the confluence of Utopia Creek and Indian River. Depressed areas containing ponded water and snow are present within the floodplain areas. Sewage effluent from the treatment facility is piped below ground to a primary pond that flows to a secondary pond that in turn flows into Indian River.

The investigation at this AOC will include determinations of the extent of buried metallic debris. This will be performed by using a metal detector along the bank of the river and creek and at the end of the runway. Contaminant migration to the floodplain areas will be determined by sampling surface water and sediment from ponded areas and the swale within the floodplain. Potential contaminant migration via the sewage treatment facility will be assessed by collecting surface water and sediment from both sewage effluent ponds. Figure 3.3-1 depicts the locations of proposed sampling points.

Surface water and sediment samples will be collected at approximately seven locations within the floodplain area, swale, and the sewage effluent ponds for laboratory analysis. The specific locations will be determined in the field and will target those areas where standing water is present and/or at areas near drums located in the Indian River floodplain. The surface water and sediment samples will be co-located to the extent possible. If surface water is not present during the field investigation, sediment will be collected. The analysis for surface water will include DRO/GRO, VOC, pesticides/PCBs, ICP metals, GFAA metals, and common anions. Laboratory analysis for sediment samples will include DRO/GRO/RRO, VOC, pesticides/PCBs, and ICP metals. Tables 3.2-1, 3.2-6, and 3.2-7 present the activity, sample number, and specific analytical methods for samples collected from the AOC.

3.3.2.8 Area of Concern No. 8 - Abandoned Incinerator, Building 125

The abandoned incinerator building is located 400 feet northeast of the residential/industrial dome complex, and approximately 750 feet southwest of Indian River (Figure 3.3-7). The building is situated on a topographically high area south of

the road to Upper Camp. The building was used as an on-station incinerator. The date of deactivation is unknown. It is currently used to store hazardous materials. North of the building is a galvanized steel culvert that appears to emanate from the building. It is not known whether the culvert originates as the floor drain observed within the building. During the May 1994 site visit, the soils beneath the culvert appeared to have been recently wetted.

The objective for investigating this AOC is to determine whether hazardous materials from the building have migrated via the culvert to the soils at the outfall of the culvert. To accomplish this objective, one soil sample will be collected from the ground surface to approximately 0.5 feet below ground surface. The sample will be collected at the discharge point of the culvert. The sample will be analyzed by the laboratory for DRO/GRO/RRO, VOC, SVOC, and ICP metals. Table 3.2-3 presents the specific analytical methods for soil analysis.

3.3.2.9 <u>Area of Concern No. 9 - Abandoned Sewage Treatment Facility</u>

The abandoned sewage treatment facility is located on the south side of Indian river, approximately 250 feet southeast of the Indian River Bridge (Figure 3.3-7). The date of abandonment is unknown. The facility includes a small building with four square steel tanks. The tanks are approximately 750 gallons each. During the May 1994 site visit, frozen liquid was observed in one of the tanks. The contents of the tanks including the presence of solid material in the tanks is unknown.

The objective of the investigation at this AOC is to characterize the solid and liquid materials in the tanks. This information will be used to assess the type and relative concentration of contamination that may be present in the solid and liquid fractions for future disposal consideration. One sample will be collected from each tank and composited into one sample for TCLP analysis.

3.3.2.10 <u>Area of Concern No. 10 - Oil/Water Separator Tank</u>

The below ground oil/water separator tank is located at the east ends of Building 112 (vehicle maintenance building) and Building 118 (vehicle storage building) (Figure 3.3-1). Information specific to the tank size, tank plumbing, and discharge point is currently unavailable. At the south end of Building 118, a 2-inch steel pipe protrudes from the ground. According to station personnel, the pipe is connected to the oil/water separator tank. Building 112 is currently unusable. During the winter of 1993/1994, snow loading caused the roof to collapse.

The objective of the investigation at this AOC is to determine the contents of the oil/water separator tank. In order to characterize potential wastes associated with the oil/water separator, one liquid sample will be collected through the steel pipe. The sample will be analyzed by the laboratory for DRO/GRO, VOC, SVOC, pesticides/PCBs, and ICP metals.

3.3.3 Creek/River Sampling

To assess potential contaminant migration to the surface water and sediment of Indian River and Utopia Creek, samples from both surface water bodies will be collected. The following sections describe both the river and the creek sampling.

3.3.3.1 Indian River

Characterization of the surface water quality of Indian River will be accomplished by collecting three surface water and sediment samples from the river. Surface water and sediment samples will be co-located where possible. Background samples will be collected from the river at an upstream location that has not been impacted by station operations. This location is expected to be accessed by Miner Road (trail to Hughes). Assessing contaminant migration to the river will be accomplished by collecting surface water and sediment samples from two locations. One location will be adjacent to the industrial/residential domes and the second will be downstream, near the end of the runway. The locations of surface water and sediment samples are shown in Figure 3.3-6.

The analyses of the sediment samples collected will include DRO/GRO/RRO, VOC, SVOC, pesticides/PCBs, and ICP metals. Surface water analyses include DRO/GRO, VOC, SVOC, pesticides/PCBs, common anions, ICP and GFAA metals, and mercury by the cold-vapor method.

3.3.3.2 Utopia Creek

The surface water quality and potential impacts to Utopia Creek will also be assessed by the collection of surface water and sediment samples (Figure 3.3-6). Where possible, surface water and sediment samples will be co-located where possible. Background surface water quality will be assessed by collecting surface water and sediment from Utopia Creek at an upstream location that has not been impacted by station operations. Access to the background location will be from Geophone Road. Two additional sample locations are planned to determine potential contaminant migration from the station. One location will be downgradient of source area LF06 landfills 3 and 4. A small stream flows through these landfills to a marshy area located north of Utopia Creek. This marshy area then drains to the creek. Surface water and sediment will be collected at the inflow of the stream to Utopia Creek. The second downgradient sample will be from a beaver pond on the creek, east of the runway.

The analysis of sediment samples collected will include DRO/GRO/RRO, VOC, SVOC, pesticides/PCBs, and ICP metals. Surface water analyses include DRO/GRO/RRO, VOC, SVOC, pesticides/PCBs, common anions, ICP and GFAA metals, and mercury by the cold-vapor method.

3.3.4 Background Sampling

Background samples for the Lower Camp area will be collected to provide a basis for comparing analytical results from downgradient locations. Background samples include soil gas, surface soil, subsurface soil, groundwater, surface water, and sediment. The locations of background samples are presented in Figure 3.3-6. Two locations for collecting background samples were identified during the May 1994 site visit. These include areas not impacted by station operations that will be accessed from Miner Road and Geophone Road. (Background surface water and sediment sampling was discussed in Section 3.3.3.)

At the Miner Road background location, one boring will be drilled for collecting subsurface soil and groundwater, if present. One surface soil sample and one seep sample will also be collected from this location. Background conditions will be further characterized by collecting subsurface soil and groundwater from one boring

located southwest of the station. One seep sample will be collected at this location, and two surface soils samples will be collected. One of the surface soil samples will be obtained from a location that is high in organic material (i.e., swampy area) and one from an area of low organic soils. This will provide a means for comparing high organic and low organic sample results at the downgradient locations.

The laboratory analyses for soils include DRO/GRO/RRO, VOC, SVOC, pesticides/PCBs, and ICP metals. Water analyses will include DRO/GRO, VOC, SVOC, pesticides/PCBs, common anions, ICP and GFAA metals, and mercury by the cold-vapor method.

3.4 UPPER CAMP INVESTIGATION

This section describes the rationale and locations of proposed sampling for the Upper Camp area. The collection of samples for both field screening and laboratory analyses is addressed. The Upper Camp investigation includes sampling at identified IRP source areas, background locations, and the Road Oiling portion of Source Area SD07.

3.4.1 IRP Source Areas

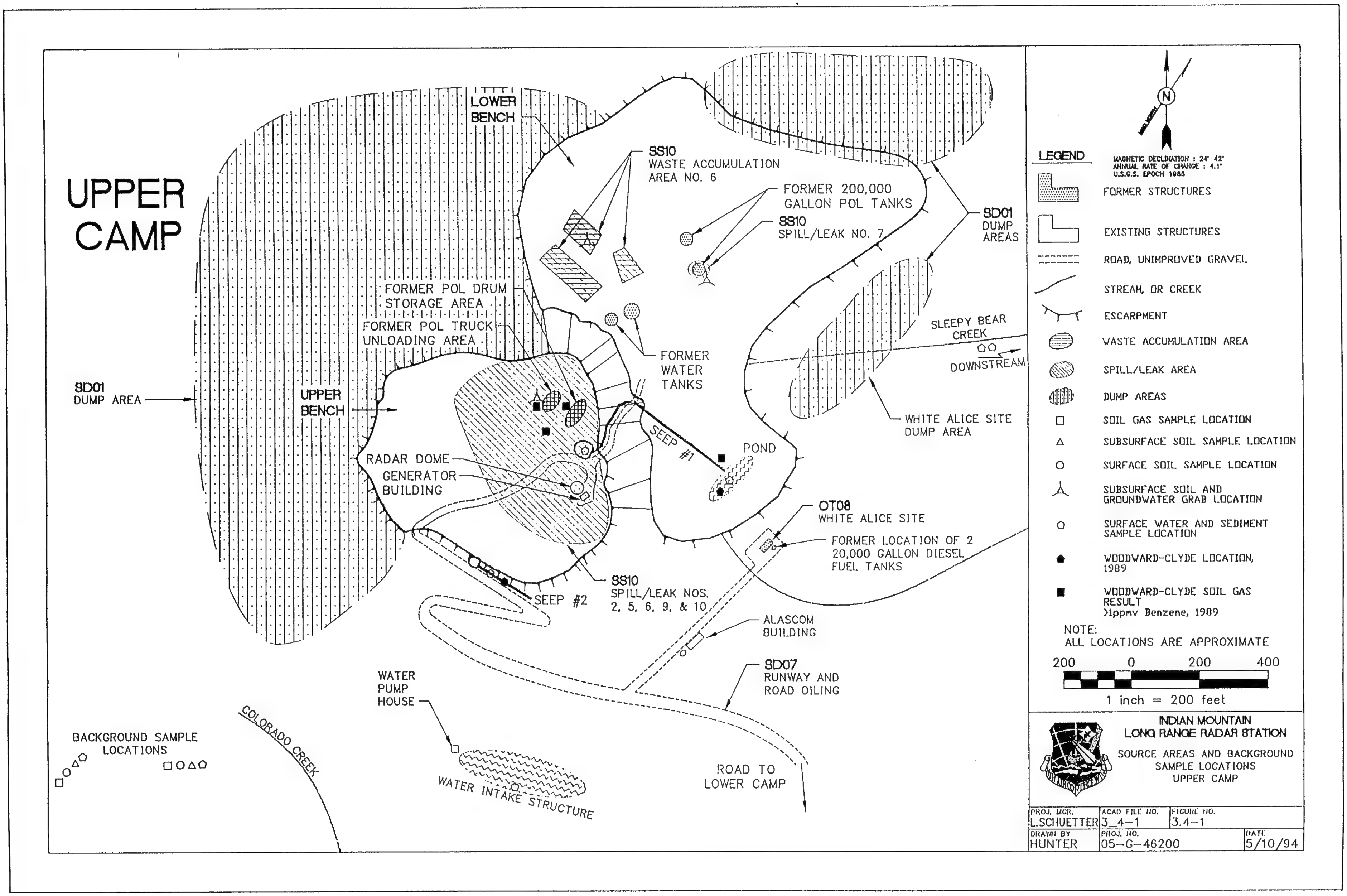
The Upper Camp includes three identified IRP source areas, SD01, OT08, and SS10. In addition, the road between Upper Camp and Lower Camp (SD07) is discussed here because most of the roadway is more similar to Upper Camp than to Lower Camp in terms of elements of the Conceptual Site Model (Section 2.3).

3.4.1.1 Source Area SD01

Source area SD01 includes the various dump areas used for general waste disposal from 1950 until the late 1970s and during demolition of the Upper Camp and WACS facilities in the late 1970s. Rubbish, wood, metal, drums, plastic, and other debris were deposited at several locations on the slopes of Indian Mountain (Figure 2.2-2) and buried. Most of the drums were drained and crushed before burial, although some of the drums may have contained small amounts of oil, ethylene glycol, or other residuals.

RI/FS activities at SD01 will concentrate on the three inferred dump areas (Figures 2.2-2 and 3.4-1) and will target potential seeps emanating from the dumps. Because of the very coarse nature of cover materials and the shallow depth of bedrock, it is probable that any leachate or liquid materials emanating from SD01 will be expressed as seeps along the margins of the dumps. The seeps will be sampled for evidence of contaminants resulting from liquid wastes or leaching of wastes by percolation of infiltrating precipitation through the dumps. Actual sampling locations will be determined following the summer 1994 site reconnaissance. Proposed locations, based on current information regarding SD01, are shown in Figure 3.4-1.

The area was covered by snow during the May 1994 site visit, so no evidence of seeps was visible. During the initial site reconnaissance in the summer of 1994, the margins of the dump areas will be searched for evidence of seeps, ponds, or other liquid discharges. For planning purposes, we have assumed that six such seeps or other liquid discharges will be identified at the margins of the dump areas. At each seep or discharge, a surface water sample will be collected; a sediment sample will be collected if possible. The samples will be submitted for laboratory analyses. Surface water/seep samples will be analyzed for DRO/GRO, VOC, SVOC,


UPPER CAMP
SD01
DUMP AREA
LOWER BENCH
UPPER BENCH
SS10
WASTE ACCUMULATION AREA NO. 6
FORMER 200,000 GALLON POL TANKS
SS10
SPILL/LEAK NO. 7
SD01
DUMP AREAS
FORMER POL DRUM STORAGE AREA
FORMER POL TRUCK UNLOADING AREA
FORMER WATER TANKS
SLEEPY BEAR CREEK
DOWNSTREAM
WHITE ALICE SITE DUMP AREA
SEEP #1
POND
RADAR DOME
GENERATOR BUILDING
OT08
WHITE ALICE SITE
FORMER LOCATION OF 2 20,000 GALLON DIESEL FUEL TANKS
SS10
SPILL/LEAK NOS. 2, 5, 6, 9, & 10
SEEP #2
ALASCOM BUILDING
SD07
RUNWAY AND ROAD OILING
WATER PUMP HOUSE
BACKGROUND SAMPLE LOCATIONS
COLORADO CREEK
WATER INTAKE STRUCTURE
ROAD TO LOWER CAMP
N
MAGNETIC DECLINATION : 24° 42'
ANNUAL RATE OF CHANGE : 4.1'
U.S.G.S. EPOCH 1985
LEGEND
FORMER STRUCTURES
EXISTING STRUCTURES
ROAD, UNIMPROVED GRAVEL
STREAM, OR CREEK
ESCARPMENT
WASTE ACCUMULATION AREA
SPILL/LEAK AREA
DUMP AREAS
SOIL GAS SAMPLE LOCATION
SUBSURFACE SOIL SAMPLE LOCATION
SURFACE SOIL SAMPLE LOCATION
SUBSURFACE SOIL AND GROUNDWATER GRAB LOCATION
SURFACE WATER AND SEDIMENT SAMPLE LOCATION
WOODWARD-CLYDE LOCATION, 1989
WOODWARD-CLYDE SOIL GAS RESULT >1ppmv Benzene, 1989
NOTE:
ALL LOCATIONS ARE APPROXIMATE
200 0 200 400
1 inch = 200 feet
INDIAN MOUNTAIN
LONG RANGE RADAR STATION
SOURCE AREAS AND BACKGROUND SAMPLE LOCATIONS UPPER CAMP
PROJ. MGR. L.SCHUETTER
ACAD FILE NO. 3_4-1
FIGURE NO. 3.4-1
DRAWN BY HUNTER
PROJ. NO. 05-G-46200
DATE 5/10/94

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pesticides/PCBs, common anions, ICP and GFAA metals. Sediment samples (if any) will be analyzed for DRO/GRO/RRO, VOC, SVOC, pesticides/PCBs, and ICP metals.

3.4.1.2 <u>Source Area SD07 (Road Oiling)</u>

Source area SD07 generally includes the runway and road areas where waste oils were applied in the past for dust suppression. The runway area was discussed in Section 3.3.1.6. The road between Upper Camp and Lower Camp is discussed here.

Upper Camp and Lower Camp are connected by a 10-mile long gravel road. Waste oils and shop wastes including solvents and ethylene glycol were routinely applied to the roadway for dust suppression from the 1950s until 1984. VOCs were detected at low, estimated levels in soil samples collected adjacent to the road in 1992.

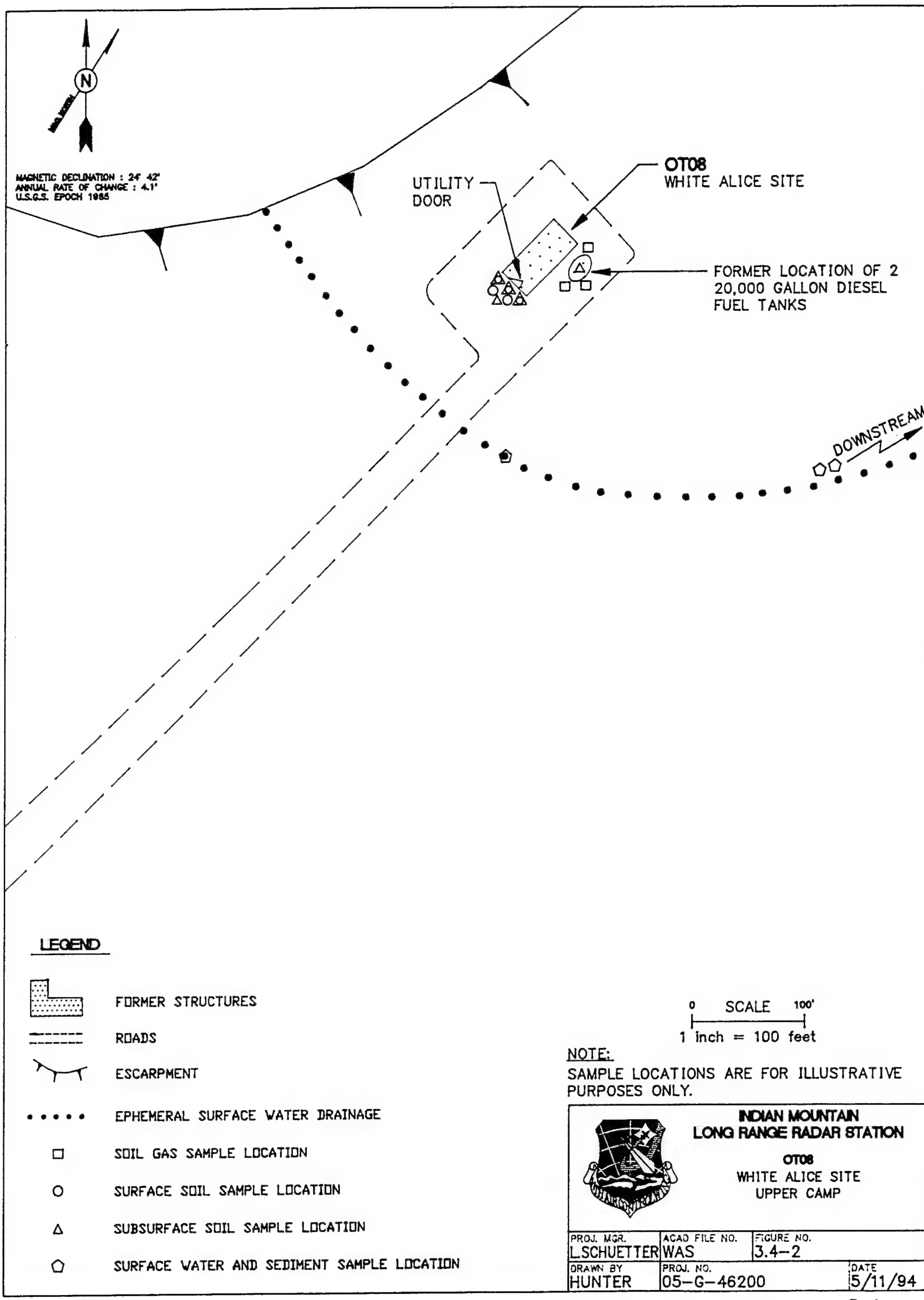
Because of the elapsed time since the last application of waste to the road and because of the frequent grading and road maintenance activities since that time, direct sampling of the roadway will not be conducted. However, areas of seeps or accumulated runoff adjacent to the roadway will be sampled. One such area of accumulated runoff was observed during the May 1994 site visit. Other seeps or water accumulations will be identified during the summer 1994 site reconnaissance. For planning purposes, we have assumed that four sampling locations will be identified. A water sample and a sediment sample will be collected from each location and submitted for laboratory analyses. The samples will be analyzed for DRO/GRO, VOC, SVOC, pesticides/PCBs, and ICP metals. The water samples will also be analyzed for lead by GFAA and common anions. The sediment sample will also be analyzed for RRO.

3.4.1.3 <u>Source Area OT08</u>

Source area OT08 consists of the former WACS site located topographically below the lower bench southeast of the existing radar dome (Figure 3.4-1). The WACS was active from 1958 to 1979 and was demolished in 1986. According to ES (1985), 85 drums of PCB-contaminated oil and 240 drums of PCB-contaminated soil were removed from the site. Previously, two 20,000 gallon diesel fuel tanks were located at the WACS facilities, although no suspected spills or leaks of diesel fuel have been reported. No field investigations have been previously conducted at OT08.

Source area OT08 will be sampled for evidence of residual contamination by PCBs or PCB-containing oils, for evidence of possible diesel fuel spills or leaks at the former storage tanks, and for evidence of possible offsite transport of PCBs or other contaminants by surface water drainages. Investigations will include soil-gas sampling at the old tank locations; field screening of surface soils for PCB contamination; and sampling of surface soil, shallow subsurface soil, surface water, and sediment for laboratory analyses. Samples will be collected at the old WACS site and from the principal surface water drainage leading away from the site. Actual sample locations will be determined following the summer 1994 site reconnaissance. Proposed locations, based on the limited available information regarding OT08, are shown in Figure 3.4-2.

A limited soil-gas survey will be conducted in the assumed vicinity of the former diesel fuel tanks. Three soil-gas samples will be collected from points immediately



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adjacent to the tank locations to the northeast, southeast, and southwest. Soil-gas samples will be analyzed in the field, using portable instruments, for VOC, oxygen, and carbon dioxide. Thirteen surface soil and sediment samples will also be collected for PCB screening using field test kits. Surface and shallow subsurface (approximately 6 inches deep) samples will be collected from five locations at OT08. In addition, three sediment samples collected from the principal drainage at specific locations to be determined during the field reconnaissance will be screened for PCB contamination.

Locations of samples for laboratory analyses will be determined based on the soil-gas and field-screening data. For planning purposes, we have assumed that up to three surface soil samples and up to two shallow subsurface soil samples will be collected to confirm the presence or absence of contamination as indicated by the soil-gas and soil-screening results. The soil samples will be analyzed for DRO/GRO/RRO, VOC, SVOC, pesticides/PCBs, and ICP metals. If the field screening of sediment samples indicates the possible presence of PCB contamination in the principal drainage from OT08, a surface water and sediment sample will be collected from the location of the furthest downgradient sediment screening sample to determine whether contamination has migrated away from OT08 via the drainage. The surface water and sediment samples will be analyzed for DRO/GRO, VOC, SVOC, pesticides/PCBs, and ICP metals. The surface water sample will also be analyzed for common anions. The sediment sample will also be analyzed for RRO.

3.4.1.4 Source Area SS10

Source area SS10 includes the former waste accumulation area no. 6 and spill/leak areas 2, 5, 6, 7, 9, and 10 (Figure 3.4-1). Waste accumulation area no. 6 was the main drum accumulation area for Upper Camp from the 1950s until the 1970s. The area was located on the lower bench, just northeast of and below the summit of Indian Mountain. Drums stored at this area reportedly contained waste oils and other liquid wastes. During the general site cleanup in the late 1970s, the drums were drained, crushed, and buried within source area SD01 (Section 3.4.1.1). The spill/leak areas included several diesel fuel spills and leaks ranging in volume from 1,500 to 46,500 gallons. Most of the spills/leaks occurred on the upper bench, although the largest release (46,500 gallons) occurred at a 200,000-gallon storage tank on the lower bench.

As indicated in the CSM (Section 2.3.1), any liquids released to the surface at the Upper Camp are likely to infiltrate the coarse surface materials, migrate down to the bedrock surface, and then travel downgradient to surface discharge points at seeps or springs along the flanks of Indian Mountain. Consequently, investigations at SS10 will focus on potential residual soil contamination in the immediate vicinity of release points, seeps emanating from the flanks of the benches, and potential downgradient discharge points in drainages flowing away from the crest of Indian Mountain including the old water intake structure north-northeast of the crest. All samples will be submitted for laboratory analyses. Proposed sample locations, subject to confirmation following the site reconnaissance, are shown in Figure 3.4-1.

Because of the previous investigations that have been conducted at SS10, no screening samples will be collected.

Surface water and sediment samples will be collected at seeps emanating from the flanks of upper and lower benches. Three of the sample points will be at previously

identified locations, including seep no. 1 on the east side of the upper bench, seep no. 2 on the southwest side of the upper bench, and the man-made pond that receives discharge from seep no. 1 (Figure 3.4-1). Three additional sample points will be selected following the summer 1994 site reconnaissance. These points will be selected at additional seeps, the pond, or other surface waters that appear to receive discharge from seeps at the margins of the benches. A surface water and sediment sample will be collected at each sampling point.

Samples will also be collected from test pits excavated into the surficial materials at probable spill locations to assess the presence of residual materials at depth. One test pit will be excavated at the former POL drum storage/truck unloading area on upper bench, one at waste accumulation area no. 6 on lower bench, and three at the former 200,000-gallon POL tanks on lower bench. At each location, a groundwater sample and a subsurface soil sample will be collected, if possible.

Water and sediment samples will also be collected at potential discharge areas located downslope from the top of Indian Mountain. One sample location will be at the former water intake structure north-northeast of the top of the mountain because contaminated liquids migrating away from Upper Camp could collect at that location and result in possible exposure to ecological receptors or casual human visitors to the area. Samples will also be collected from two locations within the Sleepy Bear Creek drainage, the principal drainage northeast of Indian Mountain. One sample location will be at a relatively flat alder grove within the cirque encompassing the headwaters of the creek, about 1.5 miles northeast of the peak of Indian Mountain. This could be a potential collection point for contaminants being carried downstream within the drainage. This location is also in the general vicinity of the location where elevated levels of TPH were detected in sediment during 1990 sampling (Air Force 1993b). The more complete laboratory analyses proposed for this sample will help determine whether the TPH was due to POL releases from Upper Camp or possibly to the presence of natural organic material in the stream sediment. The second sample location will be approximately at tree line, approximately 0.75 mile further downstream. During the site reconnaissance, this sample location will be selected within one-half mile downstream from the tree line, where sediment being transported downstream is likely to accumulate. Analyses from this location will help determine whether contaminants, if any, are being carried further downstream below the alder grove.

Sediment, soil, and water samples will be analyzed for DRO/GRO, VOC, SVOC, pesticides/PCBs, and ICP metals. The water samples will also be analyzed for GFAA metals and common anions. The sediment and soil samples will also be analyzed for RRO.

3.4.2 Other Upper Camp Seeps/Ponds

In addition to the sampling points identified in Sections 3.4.1.1 through 3.4.1.4, the summer 1994 site reconnaissance may identify other seeps or areas of ponded water not associated with specific source areas. For planning purposes, we have assumed that six such locations will be identified. At each location, a sediment sample will be collected for field screening for petroleum hydrocarbons. At the three locations with the highest petroleum hydrocarbon concentrations based on the field screening, a surface water and a sediment sample will be collected for laboratory analyses. The sediment and water samples will be analyzed for DRO/GRO, VOC, SVOC, pesticides/PCBs, and ICP metals. The water samples will also be analyzed

for GFAA metals and major anions. The sediment and soil samples will also be analyzed for RRO.

3.4.3 Background Sampling

Background samples have not been collected from the Upper Camp area. Samples are required for soil gas, surface soil, subsurface soil, surface water, and sediments. Because of the presumed lack of natural groundwater at the peak of Indian Mountain, background groundwater samples are not required. However, surface water samples may include water from natural seeps or springs that represent surface discharges of groundwater.

Appropriate sample locations will be selected during the summer 1994 site reconnaissance. If possible, two sample locations will be selected for each medium. During the May 1994 field visit, a tentative area for background sampling was identified at a secondary peak, approximately 4,000 feet in elevation and located approximately 0.75 mile southwest of the Indian Mountain peak.

Two soil sample locations will be identified, and surface and shallow subsurface soil samples will be collected at each location. Subsurface soil samples will be collected by shovel or hand auger; drilling or excavating equipment will not be used because of access problems. Soil samples for metals analyses will be collected by compositing four separate samples from the vicinity of each background location. Soil-gas probes will also be driven in the vicinity of each of the two soil-sample locations. Surface water and sediment samples will be collected from two locations in drainages near the background area, if possible. If no surface water is present in drainages near the background area, sediment samples will be collected from two dry drainages, and attempts will be made to locate seeps, springs, or local accumulations of surface water representative of the background area.

Background soil, sediment, and water samples will be submitted to the laboratory for laboratory analyses for DRO/GRO, VOC, SVOC, pesticides/PCBs, and ICP metals. The water samples will also be analyzed for GFAA metals, mercury by the cold-vapor method, and common anions. Soil and sediment samples will also be analyzed for RRO. Soil-gas samples will be analyzed by field instruments for VOC, oxygen, and carbon dioxide.

3.5 LITERATURE SEARCH

The goal of the literature search is to identify and evaluate existing information pertaining to Indian Mountain LRRS. Information obtained through the search is used to identify potential contamination from past waste disposal practices and to identify potential migration pathways. The following resources have been identified for the literature search: previous environmental investigation reports, contractor reports, aerial photographs, facility drawings and figures, USGS reports and soil boring logs, the ADF&G, U.S. Fish and Wildlife Service (FWS), U.S. Bureau of Land Management (BLM), and records of telephone communications with personnel familiar with the facility. Documents obtained from the literature search are compiled and maintained in the document control file.

3.6 RECORD KEEPING

All field personnel will be responsible for keeping accurate records of each field task performed. Field records will contain sufficient detail to relocate all sampling

locations and measurement activities and to meet the Installation Restoration Program Information Management System (IRPIMS) data requirements. The field coordinator will be responsible for ensuring that all pertinent paperwork is filled out before the completion of each field task/sampling event. Field books will be permanently bound with sequentially numbered pages. Copies of field documentation will be kept in the document control file for Air Force projects. Field documentation will be attached to the RI/FS report. For all field activities, the following information will be included in field logbooks:

- location;
- date and time;
- identity of field personnel;
- field equipment and calibration information;
- sample type and collection method;
- sample preservation;
- detailed sample location and sample depths ;
- sample volume;
- chain-of-custody and sample numbers;
- QA/QC samples; and
- identification of conditions that could affect sample integrity or representativeness.

Documentation of sampling activities will also be recorded in the field, in tabular form, and on personal computers, as data become available. This information will be used to monitor RI/FS field activity progress and analytical laboratory sample tracking.

3.7 DATA ASSESSMENT

At the conclusion of field activities and laboratory analysis, the quality of data resulting from the RI/FS activities will be assessed. The data quality assessment will be presented in the RI/FS report. The following section describes the data assessment procedure for the field records. The description of laboratory analytical data assessment procedures will be included in the QAPP.

Data assessment includes identification and evaluation of valid data. Field data records will be assessed using the following requirements: completeness, validity, correlation to field data and/or additional test data, identification of anomalous data, accuracy and precision of field parameters or measurements, and compliance to the Work Plan and SAP.

Completeness of field records will verify that all field activities are documented and that pertinent information for each sampling event is present. Validity of field records will be used to cross check and identify potential problems with sampling

procedures or sample integrity. Correlation to other field data or measurements such as field parameters and duplicate samples will further aid in identifying problem areas related to field activities. The identification of anomalous data will be noted and an explanation provided if possible. Field documentation such as calibration procedures will be used to identify anomalous field data. The accuracy and precision of field measurements will be discussed in the corrective action report. Compliance with the Work Plan and SAP will ensure that the objectives for each field activity were met.

3.8 CHARACTERIZATION OF BACKGROUND CONDITIONS

Background samples of selected environmental media were collected from Lower Camp for laboratory analysis by W-C during the 1992 SI. Background samples have not been collected from Upper Camp. Analytical results for the background samples are summarized in Table 2.3-2 in Section 2.3, Conceptual Site Model, and in this subsection.

One background surface soil sample, one subsurface soil sample, and one sediment sample were collected at locations upgradient to sources in Lower Camp and were analyzed for pesticides/PCBs and TAL metals. Background surface water and groundwater samples were not collected for Lower Camp. The background sample analyses were validated and found to be of acceptable quality to meet IRP RI/FS requirements. Lower Camp background sample contaminant concentrations are summarized in the following paragraphs.

Surface Soil. Low and estimated (J) concentrations of several pesticides were detected in the background surface soil sample. Contaminants detected include alpha-BHC (8.7J μg/kg), aldrin (8.3 μg/kg), 4,4'-DDE (26J μg/kg), 4,4'-DDD (5.8J μg/kg), and 4,4'-DDT (200J μg/kg). These pesticides and metals detected in the surface soil sample were below action levels.

Subsurface Soil. The pesticide 4,4'-DDT was detected in the subsurface soil background sample at a concentration of 1.2J μg/kg. This pesticide and metals were detected at concentrations below action levels.

Sediment. A background sediment sample was collected from both Utopia Creek and Indian River. Pesticides/PCBs were not detected in either sample. Arsenic in the sediment sample from Utopia Creek was detected at a concentration approximately two times the PRG based on a target level concentration corresponding to a carcinogenic risk of 1×10^{-6}. All other metals in both samples were below action levels.

As previously discussed, background surface water and groundwater samples have not been collected for Lower Camp. Sediment and soil samples from Lower Camp have not been analyzed for VOCs and SVOCs. No background samples have been collected for Upper Camp. Results for these samples are identified as data gaps to be addressed during the 1994 RI. Background surface soil, subsurface soil, surface water, sediment, and groundwater samples will be collected for Lower Camp. Background surface soil, subsurface soil, surface water, and sediment samples will be collected for Upper Camp. Based on current knowledge of the environmental setting at Upper Camp, true groundwater is not present on Indian Mountain.

At a minimum, the background samples collected for the Lower and Upper camps during the 1994 RI will be analyzed for the following:

- VOCs (SW8240/8260);
- SVOCs (SW8270);
- pesticides/PCBs (SW8080);
- arsenic (SW7060);
- lead (SW7421); and
- total metals (SW6010).

These analyses are also designated for samples from sources within each camp. Source sample results will be compared to background sample results when the data are available following completion of the fieldwork. Based on this comparison and statistical evaluation, if required, acceptable ranges of background concentrations for detected contaminants will be suggested for determination of contaminants significantly above background. Based on the geologic characteristics associated with the Indian Mountain LRRS area, metals, as well as organic contaminants, will also be compared to PRGs.

3.9 QUALITATIVE RISK EVALUATION

A qualitative risk evaluation will be completed to estimate the potential risk to human health and the environment resulting from exposure to site contaminants in the absence of remediation. The qualitative risk evaluation will be completed through a comparison of site contaminant concentrations and identified chemical-specific, risk-based ARARs and risk-based PRGs. Section 2.5 presented the ARARs identified for use in the qualitative risk evaluation, and Section 2.3 presented the exposure assumptions used to develop project-specific PRGs.

For both the ecological and human health levels, the ARAR values and/or exposure assumptions made are conservative in nature and should allow the Air Force to make sound decisions concerning whether sources or areas will need to be looked at further on a quantitative basis or whether no further action can be proposed.

The need to conduct quantitative risk assessments for human health and ecological resources will be based on whether detected contaminant concentrations exceed identified ARARs or PRGs. The results of the qualitative risk evaluation will be used to perform the following:

- conservatively estimate potential risk to human health and the environment;
- identify the need for the completion of a quantitative risk assessment;
- identify data gaps and needs; and
- support a NFRAP decision.

The objectives of the qualitative risk evaluation are to identify chemicals that may be occurring at concentrations above natural conditions and that are above federal and state ARARs or PRGs. All past and current chemical data associated with each source or area will be evaluated. Contaminants of potential concern will be identified based on the CSM (Section 2.3), background chemical concentrations, and federal and state ARARs.

3.9.1 Ecological Risk Evaluation

Analytical data will be collected to provide preliminary data for the evaluation of potential ecological exposure. In support of the ecological risk evaluation, surface soil, surface water (e.g., streams and wetlands), and sediment samples will be

collected to identify contaminants and contaminant concentrations. Analytical data will also be used to determine the potential for contaminant migration that may impact ecological receptors and their habitats. The CSMs described in Section 2.3 present preliminary exposure scenarios based on literature review.

Sediment samples from both Indian River and Utopia Creek were collected during the 1992 SI. Contaminant concentrations detected in the samples were compared to risk-based ecological criteria published by National Oceanic and Atmospheric Administration (NOAA) for sediment. None of the analytical detections exceeded the NOAA action levels. An evaluation will be made when the data from the 1994 RI are available to determine if contaminants detected in surface water and sediment samples are above the risk-based ecological action levels. Ecological action levels are included in Table 2.5-1.

3.10 BENCH-SCALE/TREATABILITY STUDIES

No bench-scale tests or treatability studies will be conducted as part of this project.

3.11 DETAILED ANALYSIS OF ALTERNATIVES

A detailed analysis of potential remedial alternatives developed following completion of the RI will be conducted in accordance with EPA guidance (EPA 1988) and Air Force guidance (Air Force 1993a). Each alternative will be evaluated for the following EPA criteria:

- overall protection of human health and the environment;
- compliance with ARARs;
- long-term effectiveness and permanence;
- reduction of toxicity, mobility, or volume;
- short-term effectiveness;
- implementability;
- cost;
- state acceptance; and
- community acceptance.

In addition, the remedial alternatives will be evaluated for the following criteria specified in the Air Force Handbook (Air Force 1993a):

- successful application of the technology under site conditions;
- total project cost;
- risk reduction;
- project duration; and
- data gaps.

The result of the detailed analysis of alternatives will be the identification of a preferred alternative(s) for remediation at Indian Mountain LRRS. The alternative(s) will be presented in decision documents (Section 4.2). A discussion of the detailed analysis of alternatives will be included in the RI/FS report (Section 4.3).

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4.0 REPORTING REQUIREMENTS

Several types of reports will be prepared both during and after completion of the RI fieldwork. The following sections describe the data management requirements, decision documents, the RI/FS report, letter reports, and the weekly status reports.

4.1 DATA MANAGEMENT

Jacobs will enter all information from the field effort into the Jacobs Environmental Management System (JEMS) database system. This database will allow preparation of IRPIMS data submittals to the Air Force as specified in the Statement of Work. All data will be entered as soon as possible after collection or after analytical results are received and validated. Data entries will be checked for accuracy and completeness before the IRPIMS submittal is prepared.

The JEMS data management system will also allow for data manipulation as well as interpretation. The data interpretation programs will generate summary tables, boring logs, cross sections, contour maps, etc., each of which will assist in the preparation of the RI/FS report.

4.2 DECISION DOCUMENTS

Jacobs will prepare decision documents for Indian Mountain LRRS following completion of the RI/FS activities. The type(s) of documents to be prepared will depend on the results of the field effort. The results of the field effort will determine whether NFRAP documents or proposed plans are prepared for individual source areas, for each of the two camps (Upper and Lower) or for Indian Mountain LRRS as a whole.

The decision documents will follow EPA guidance (EPA 1988), State of Alaska guidance (ADEC 1992), and Air Force guidance (Air Force 1993c). The documents will contain all of the required information to enable the Air Force and regulatory agencies to make decisions on the final disposition of the sources at Indian Mountain LRRS.

4.3 REMEDIAL INVESTIGATION/FEASIBILITY STUDY REPORT

The RI/FS report will be prepared in accordance with EPA (EPA 1988) and Air Force (Air Force 1993a) guidance. The report will include detailed discussions of the following:

- history of Indian Mountain LRRS;
- project activities including RI field activities, waste management, field QA/QC, laboratory analysis, and data evaluation;
- physical setting including geology, hydrogeology, hydrology, climate, and demography;
- discussion of analytical results;
- qualitative baseline and ecological risk assessments;
- an updated CSM;

- updated ARARs;
- updated exposure assumptions;
- development of remedial alternatives; and
- alternatives analysis.

4.4 ANALYTICAL DATA INFORMAL TECHNICAL INFORMATION REPORT

The Analytical Data Informal Technical Information Report (ITIR) will be submitted following receipt of all analytical results and data validation reports. The ITIR will follow the format specified in Section 3.0 of the Air Force IRP Handbook (Air Force 1993a).

4.5 INTERIM LETTER REPORTS

Interim letter reports will be submitted to the Air Force as project progress indicates.

4.6 WEEKLY STATUS REPORTS

During the RI field activities, a weekly status report will be sent to the Air Force. This report will include the following:

- a summary of all activities;
- a list of onsite personnel;
- a description of types and numbers of samples collected;
- a list of samples sent to the laboratory;
- copies of borehole lithologic logs, if applicable;
- a summary of plans for the following week; and
- a list of potential problems, proposed solutions, and outstanding issues requiring resolution.

5.0 PROJECT SCHEDULE

The proposed project schedule for all technical activities is shown in Figure 5.0-1. A presurvey site visit was conducted in May 1994. Information obtained during this site visit will be used to finalize the Work Plan and SAP in preparation for the RI field activities. Planning and coordination of the field activities began in March 1994 and will continue through the finalization of the planning documents. Fieldwork will begin in July 1994 and is expected to last approximately four weeks. Preparation of the RI/FS report and the decision documents will begin after fieldwork is completed.

ACTIVITY ID	ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH
	PROJECT START/FINISH		
1000-00	PROJECT START	18FEB94A	
9000-00	PROJECT FINISH		31JUL95
	RI/FS SCOPING - Meetings, Conferences, Etc		
1001-01B	MEETINGS, CONFERENCES, SITE VISITS - YR 2	6JAN95	4JUL95
1001-01A	MEETINGS, CONFERENCES, SITE VISITS - YR 1	4JUL94	30DEC94
	RI/FS SCOPING - Special Notification Health Risk		
1001-02B	PERSONNEL CHART (CDRL A003)	15APR94A	15APR94A
1001-02A	SPECIAL NOTIFICATION HEALTH RISK (CDRL A015)	15JUL94	23NOV94
	RI/FS SCOPING - Laboratories		
1001-03A	LABORATORIES	29MAR94A	18NOV94
	RI/FS SCOPING - Delivery Order Scoping		
1001-04A	BACKGROUND REVIEW	29MAR94A	4APR94A
1001-04B	PRE-SURVEY	16MAY94A	20MAY94A
	RI/FS SCOPING - Health & Safety Plan		
1001-05A	PREPARE ADVANCE DRAFT HSP	29MAR94A	12MAY94A
1001-05B	SUBMIT ADVANCE DRAFT HSP	13MAY94A	13MAY94A
1001-05C	AIR FORCE REVIEW ADVANCE DRAFT HSP	16MAY94A	20MAY94A
1001-05D	PREPARE DRAFT HSP	23MAY94A	5JUN94A
1001-05E	SUBMIT DRAFT HSP	3JUN94A	3JUN94A
1001-05F	AIR FORCE/AGENCY REVIEW DRAFT HSP	6JUN94A	27JUN94A
1001-05G	PREPARE RESPONSE TO COMMENTS (HSP)	28JUN94A	7JUL94
1001-05I	PREPARE FINAL HSP	28JUN94A	21JUL94
1001-05H	SUBMIT RESPONSE TO COMMENTS (HSP)	8JUL94	8JUL94
1001-05J	SUBMIT FINAL HSP	22JUL94	22JUL94
	RI/FS SCOPING - Work Plan		
1001-06A	PREPARE ADVANCE DRAFT WORK PLAN	5APR94A	12MAY94A
1001-06B	SUBMIT ADVANCE DRAFT WORK PLAN	13MAY94A	13MAY94A
1001-06C	AIR FORCE REVIEW ADVANCE DRAFT WORK PLAN	16MAY94A	20MAY94A
1001-06D	PREPARE DRAFT WORK PLAN	23MAY94A	2JUN94A
1001-06E	SUBMIT DRAFT WORK PLAN	3JUN94A	3JUN94A
1001-06F	AIR FORCE/AGENCY REVIEW	6JUN94A	27JUN94A
1001-06G	PREPARE RESPONSE TO COMMENTS (WP)	28JUN94A	7JUL94
1001-06I	PREPARE FINAL WORK PLAN	28JUN94A	21JUL94
1001-06H	SUBMIT RESPONSE TO COMMENTS (WP)	8JUL94	8JUL94
1001-06J	SUBMIT FINAL WORK PLAN	22JUL94	22JUL94
	RI/FS SCOPING - QAPP		
1001-07A	PREPARE ADVANCE DRAFT QAPP	5APR94A	12MAY94A
1001-07B	SUBMIT ADVANCE DRAFT QAPP	13MAY94A	13MAY94A
1001-07C	AIR FORCE REVIEW ADVANCE DRAFT QAPP	16MAY94A	20MAY94A
1001-07D	PREPARE DRAFT QAPP	23MAY94A	2JUN94A
1001-07E	SUBMIT DRAFT QAPP	3JUN94A	3JUN94A
1001-07F	AIR FORCE/AGENCY REVIEW QAPP	6JUN94A	27JUN94A
1001-07G	PREPARE RESPONSE TO COMMENTS (QAPP)	28JUN94A	7JUL94
1001-07I	PREPARE FINAL QAPP	28JUN94A	21JUL94

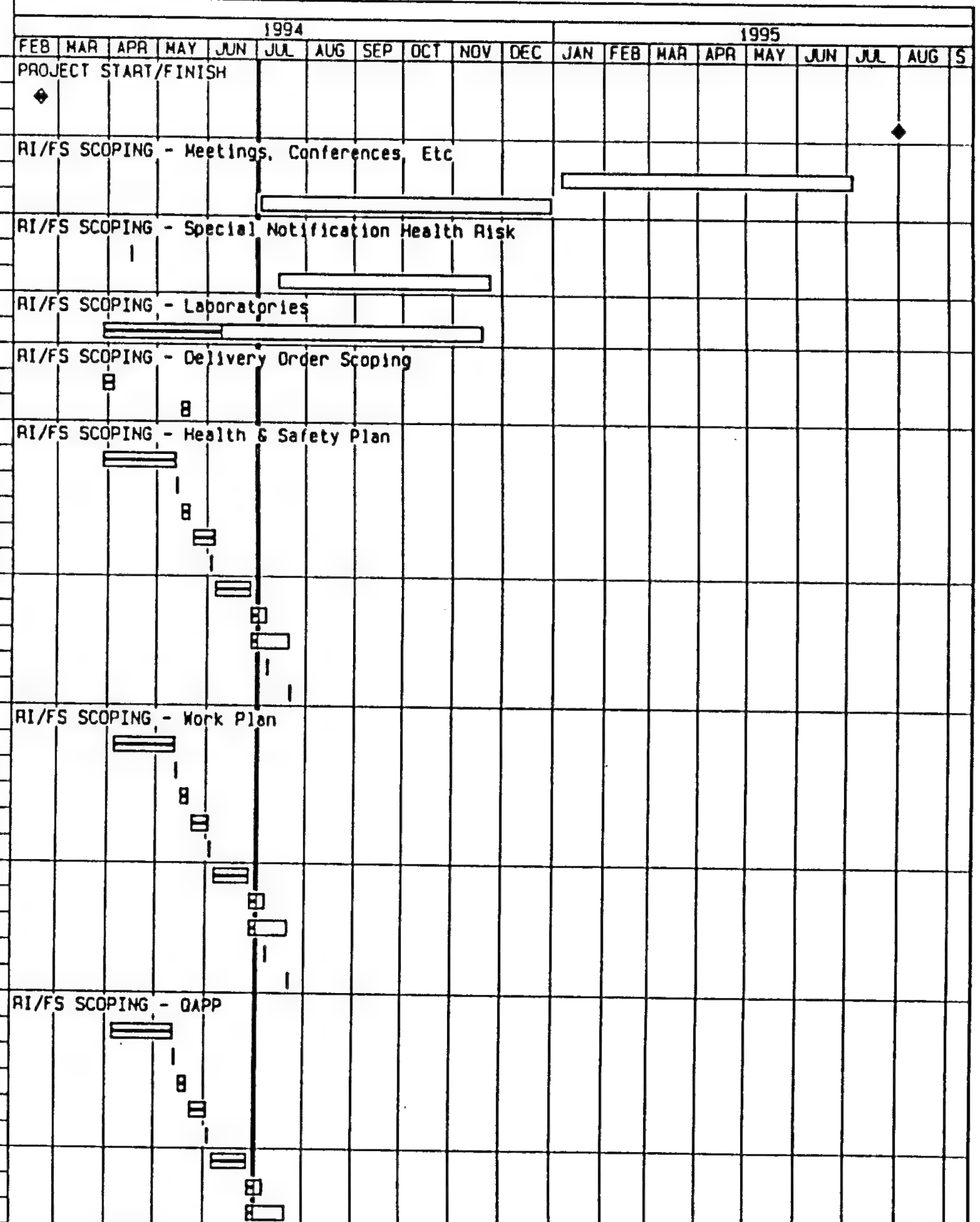

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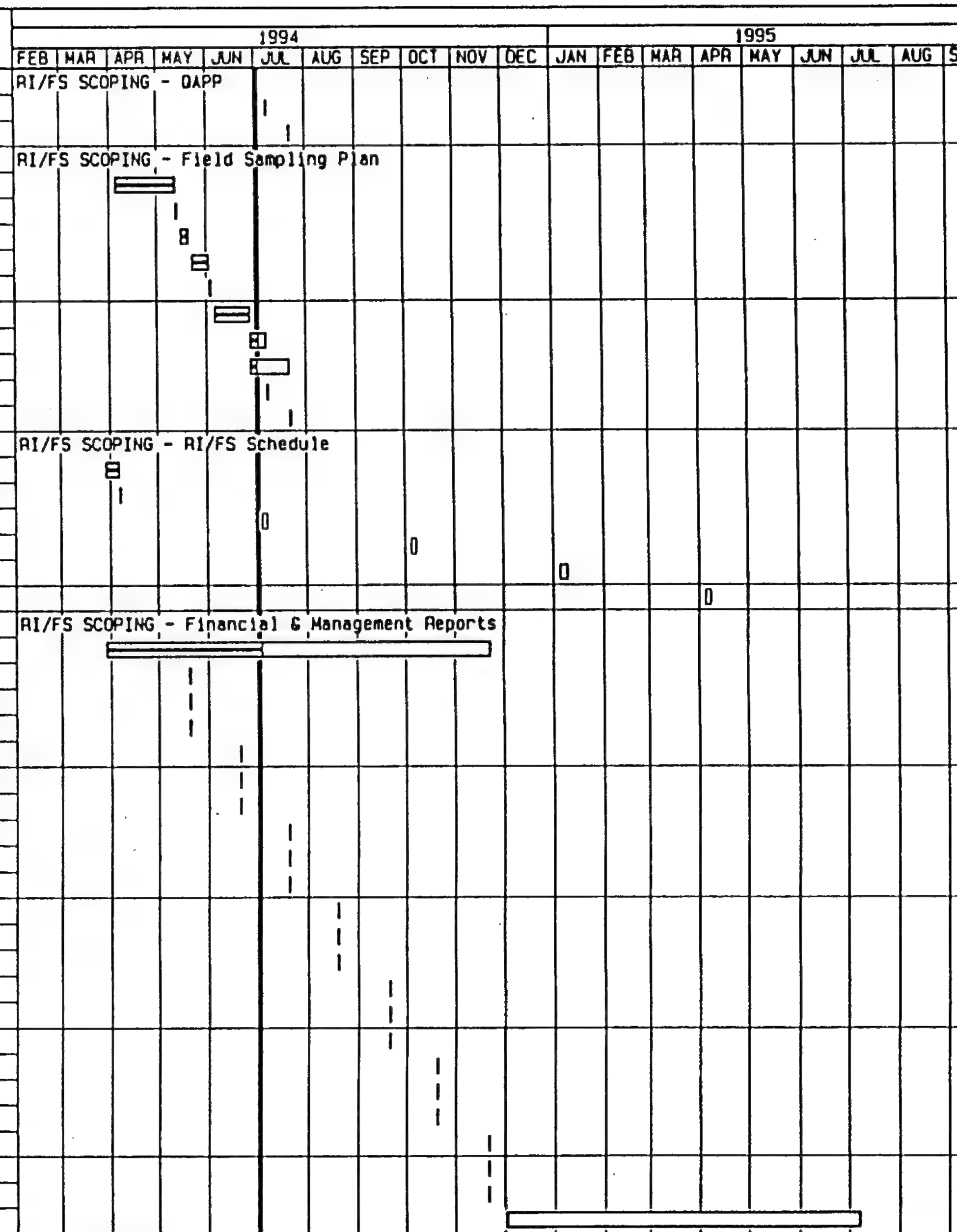
Figure 5.0-1

Project Schedule

Indian Mountain LRRS, Alaska

ACTIVITY ID	ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH
	RI/FS SCOPING - OAPP		
1001-07H	SUBMIT RESPONSE TO COMMENTS (OAPP)	8JUL94	8JUL94
1001-07J	SUBMIT FINAL OAPP	22JUL94	22JUL94
	RI/FS SCOPING - Field Sampling Plan		
1001-08A	PREPARE ADVANCE DRAFT FIELD SAMPLING PLAN	5APR94A	12MAY94A
1001-08B	SUBMIT ADVANCE DRAFT FIELD SAMPLING PLAN	13MAY94A	13MAY94A
1001-08C	AIR FORCE REVIEW FIELD SAMPLING PLAN	16MAY94A	20MAY94A
1001-08D	PREPARE DRAFT FIELD SAMPLING PLAN	23MAY94A	2JUN94A
1001-08E	SUBMIT DRAFT FIELD SAMPLING PLAN	3JUN94A	3JUN94A
1001-08F	AIR FORCE/AGENCY REVIEW (FIELD SAMPLING PLAN)	6JUN94A	27JUN94A
1001-08G	PREPARE RESPONSE TO COMMENTS (FIELD SAMP. PLAN)	28JUN94A	7JUL94
1001-08I	PREPARE FINAL FIELD SAMPLING PLAN	28JUN94A	21JUL94
1001-08H	SUBMIT RESPONSE TO COMMENTS (FIELD SAMP. PLAN)	8JUL94	8JUL94
1001-08J	SUBMIT FINAL FIELD SAMPLING PLAN	22JUL94	22JUL94
	RI/FS SCOPING - RI/FS Schedule		
1001-09A	INITIAL PREPARATION RI/FS SCHEDULE	29MAR94A	6APR94A
1001-09B	SUBMIT INITIAL RI/FS SCHEDULE	7APR94A	7APR94A
1001-09C	1ST QUARTERLY UPDATE RI/FS SCHEDULE	5JUL94	7JUL94
1001-09D	2ND QUARTERLY UPDATE RI/FS SCHEDULE	5OCT94	7OCT94
1001-09E	3RD QUARTERLY UPDATE RI/FS SCHEDULE	5JAN95	9JAN95
1001-09F	4TH QUARTERLY UPDATE RI/FS SCHEDULE	5APR95	7APR95
	RI/FS SCOPING - Financial & Management Reports		
1001-10A	MONTHLY FINANCIAL & MANAGEMENT REPORTS - YR 1	29MAR94A	22NOV94
1001-10F	SUBMIT PERFORMANCE & COST REPORT (CDRL A001)	20MAY94A	20MAY94A
1001-10G	SUBMIT MANHOUR EXPENDITURE CHART (CDRL A002)	20MAY94A	20MAY94A
1001-10H	SUBMIT STATUS REPORT (CDRL A003)	20MAY94A	20MAY94A
1001-10I	SUBMIT PERFORMANCE & COST REPORT (CDRL A001)	20JUN94A	20JUN94A
1001-10J	SUBMIT MANHOUR EXPENDITURE CHART (CDRL A002)	20JUN94A	20JUN94A
1001-10K	SUBMIT STATUS REPORT (CDRL A003)	20JUN94A	20JUN94A
1001-10L	SUBMIT PERFORMANCE & COST REPORT (CDRL A001)	20JUL94	20JUL94
1001-10M	SUBMIT MANHOUR EXPENDITURE CHART (CDRL A002)	20JUL94	20JUL94
1001-10N	SUBMIT STATUS REPORT (CDRL A003)	20JUL94	20JUL94
1001-10O	SUBMIT PERFORMANCE & COST REPORT	19AUG94	19AUG94
1001-10P	SUBMIT MANHOUR EXPENDITURE CHART (CDRL A002)	19AUG94	19AUG94
1001-10Q	SUBMIT STATUS REPORT (CDRL A003)	19AUG94	19AUG94
1001-10R	SUBMIT PERFORMANCE & COST REPORT (CDRL A001)	20SEP94	20SEP94
1001-10S	SUBMIT MANHOUR EXPENDITURE CHART (CDRL A002)	20SEP94	20SEP94
1001-10T	SUBMIT STATUS REPORT (CDRL A003)	20SEP94	20SEP94
1001-10U	SUBMIT PERFORMANCE & COST REPORT (CDRL A001)	20OCT94	20OCT94
1001-10V	SUBMIT MANHOUR EXPENDITURE CHART (CDRL A002)	20OCT94	20OCT94
1001-10W	SUBMIT STATUS REPORT (CDRL A003)	20OCT94	20OCT94
1001-10X	SUBMIT PERFORMANCE & COST REPORT (CDRL A001)	21NOV94	21NOV94
1001-10Y	SUBMIT MANHOUR EXPENDITURE CHART (CDRL A002)	21NOV94	21NOV94
1001-10Z	SUBMIT STATUS REPORT (CDRL A003)	21NOV94	21NOV94
1001-10B	MONTHLY FINANCIAL & MANAGEMENT REPORTS - YR 2	2DEC94	7JUL95



Plot Date 7JUL94
Data Date 5JUL94
Project Start 1FEB94
Project Finish 31JUL95

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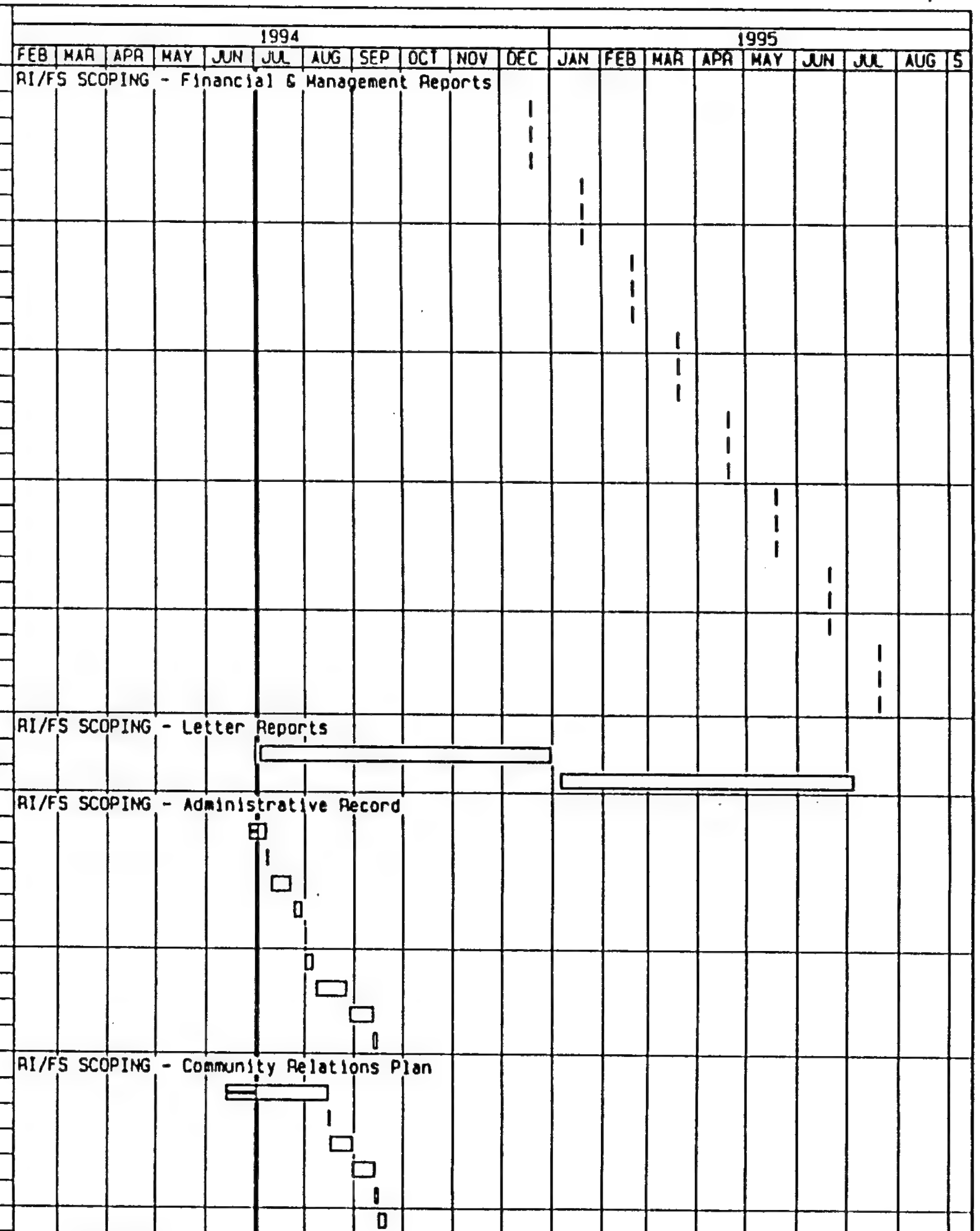
Figure 5.0-1

Project Schedule

Indian Mountain LRRS, Alaska

ACTIVITY ID	ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH
	RI/FS SCOPING - Financial & Management Reports		
1001-10AA	SUBMIT PERFORMANCE & COST REPORT (CDRL A001)	20DEC94	20DEC94
1001-10AB	SUBMIT MANHOUR EXPENDITURE CHART (CDRL A002)	20DEC94	20DEC94
1001-10AC	SUBMIT STATUS REPORT (CDRL A003)	20DEC94	20DEC94
1001-10AD	SUBMIT PERFORMANCE & COST REPORT (CDRL A001)	20JAN95	20JAN95
1001-10AE	SUBMIT MANHOUR EXPENDITURE CHART (CDRL A002)	20JAN95	20JAN95
1001-10AF	SUBMIT STATUS REPORT (CDRL A003)	20JAN95	20JAN95
1001-10AG	SUBMIT PERFORMANCE & COST REPORT (CDRL A001)	20FEB95	20FEB95
1001-10AH	SUBMIT MANHOUR EXPENDITURE CHART (CDRL A002)	20FEB95	20FEB95
1001-10AI	SUBMIT STATUS REPORT (CDRL A003)	20FEB95	20FEB95
1001-10AJ	SUBMIT PERFORMANCE & COST REPORT (CDRL A001)	20MAR95	20MAR95
1001-10AK	SUBMIT MANHOUR EXPENDITURE CHART (CDRL A002)	20MAR95	20MAR95
1001-10AL	SUBMIT STATUS REPORT (CDRL A003)	20MAR95	20MAR95
1001-10AM	SUBMIT PERFORMANCE & COST REPORT (CDRL A001)	20APR95	20APR95
1001-10AN	SUBMIT MANHOUR EXPENDITURE CHART (CDRL A002)	20APR95	20APR95
1001-10AO	SUBMIT STATUS REPORT (CDRL A003)	20APR95	20APR95
1001-10AP	SUBMIT PERFORMANCE & COST REPORT (CDRL A001)	19MAY95	19MAY95
1001-10AQ	SUBMIT MANHOUR EXPENDITURE CHART (CDRL A002)	19MAY95	19MAY95
1001-10AR	SUBMIT STATUS REPORT (CDRL A003)	19MAY95	19MAY95
1001-10AS	SUBMIT PERFORMANCE & COST REPORT (CDRL A001)	20JUN95	20JUN95
1001-10AT	SUBMIT MANHOUR EXPENDITURE CHART (CDRL A002)	20JUN95	20JUN95
1001-10AU	SUBMIT STATUS REPORT (CDRL A003)	20JUN95	20JUN95
1001-10AV	SUBMIT PERFORMANCE & COST REPORT (CDRL A001)	20JUL95	20JUL95
1001-10AW	SUBMIT MANHOUR EXPENDITURE CHART (CDRL A002)	20JUL95	20JUL95
1001-10AX	SUBMIT STATUS REPORT (CDRL A003)	20JUL95	20JUL95
	RI/FS SCOPING - Letter Reports		
1001-11A	LETTER REPORTS - YR 1	4JUL94	30DEC94
1001-11B	LETTER REPORTS - YR 2	6JAN95	4JUL95
	RI/FS SCOPING - Administrative Record		
1001-12A	Prepare Draft Letter Report	27JUN94A	7JUL94
1001-12B	Submit Draft Letter Report	8JUL94	8JUL94
1001-12C	AF Review (Draft Letter Report)	11JUL94	22JUL94
1001-12D	Prepare Final Letter Report	25JUL94	29JUL94
1001-12E	Submit Final Letter Report	1AUG94	1AUG94
1001-12F	Develop Index Database	1AUG94	5AUG94
1001-12G	Process Documents	8AUG94	26AUG94
1001-12H	Prepare Users Manual	29AUG94	12SEP94
1001-12I	Deliver Documents and Index	13SEP94	14SEP94
	RI/FS SCOPING - Community Relations Plan		
1001-13A	Prepare Draft Community Relations Plan	13JUN94A	15AUG94
1001-13B	Submit Draft Community Relations Plan	16AUG94	16AUG94
1001-13C	Air Force Review (Draft CRP)	17AUG94	30AUG94
1001-13D	Prepare Advance Final CRP	31AUG94	13SEP94
1001-13E	Submit Advance Final CRP	14SEP94	15SEP94
1001-13F	AF Review (Advance Final CRP)	16SEP94	20SEP94



Plot Date 7JUL94
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Project Start 1FEB94
Project Finish 31JUL95

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Figure 5.0-1

Project Schedule

Indian Mountain LRRS, Alaska

ACTIVITY ID	ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH
	RI/FS SCOPING - Community Relations Plan		
1001-13G	Prepare Final CRP	21SEP94	26SEP94
1001-13H	Submit Final CRP	27SEP94	27SEP94
	RI/FS SCOPING - Photo Document/Notebook		
1001-14A	Prepare Draft Photo Notebook	5OCT94	29NOV94
1001-14B	Submit Draft Photo Notebook	30NOV94	30NOV94
1001-14C	Air Force Review (Draft Photo Notebook)	1DEC94	14DEC94
1001-14D	Prepare Final Photo Notebook	15DEC94	20JAN95
1001-14E	Submit Final Photo Notebook	23JAN95	24JAN95
	RI/FS SCOPING - Newsletters/Factsheets		
1001-15A	Prepare Draft IRP Fact Sheet	13JUN94A	15AUG94
1001-15B	Submit Draft IRP Fact Sheet	16AUG94	16AUG94
1001-15C	Air Force Review (Draft IRP Fact Sheet)	17AUG94	14SEP94
1001-15D	Prepare Final IRP Fact Sheet	15SEP94	22SEP94
1001-15E	Submit Final IRP Fact Sheet	23SEP94	23SEP94
1001-15F	Air Force Review (Final IRP Fact Sheet)	26SEP94	30SEP94
1001-15G	Print Final IRP Fact Sheet	3OCT94	7OCT94
1001-15H	Distribute Final IRP Fact Sheet	10OCT94	11OCT94
1001-15I	Prepare Newsletter Outline	14NOV94	15NOV94
1001-15J	Submit Newsletter Outline	16NOV94	16NOV94
1001-15K	Air Force Review (Newsletter Outline)	17NOV94	21NOV94
1001-15L	Prepare Draft Newsletter	22NOV94	26DEC94
1001-15M	Submit Draft Newsletter	27DEC94	27DEC94
1001-15N	Air Force Review (Draft Newsletter)	28DEC94	25JAN95
1001-15O	Prepare Final Newsletter	26JAN95	31JAN95
1001-15P	Submit Final Newsletter	1FEB95	1FEB95
1001-15Q	Air Force Review (Final Newsletter)	2FEB95	8FEB95
1001-15R	Print Final Newsletter	9FEB95	15FEB95
1001-15S	Distribute Final Newsletter	16FEB95	17FEB95
	RI/FS SCOPING - Indian Mt Comprehensive IRP Plan		
1001-16A	DEVELOP INDIAN MOUNTAIN IRP PLAN - DRAFT TBD	4JUL94	5JAN95
1001-16B	SUBMIT INDIAN MOUNTAIN IRP PLAN - DRAFT	6JAN95	6JAN95
1001-16C	DEVELOP INDIAN MOUNTAIN IRP PLAN - FINAL	13JAN95	6JUN95
1001-16D	SUBMIT INDIAN MOUNTAIN IRP PLAN - FINAL	7JUN95	7JUN95
	RI/FS SCOPING - Management Tasks		
1001-91A	DELIVERY ORDER MANAGEMENT - YR 1	29MAR94A	22NOV94
1001-91B	DELIVERY ORDER MANAGEMENT - YR 2	2DEC94	7JUL95
1001-92A	COST/SCHEDULE - YR 1	29MAR94A	22NOV94
1001-92B	COST/SCHEDULE - YR 2	2DEC94	7JUL95
1001-93A	ACCOUNTING - YR 1	29MAR94A	22NOV94
1001-93B	ACCOUNTING - YR 2	2DEC94	7JUL95
1001-94A	CONTRACTS - YR 1	29MAR94A	22NOV94
1001-94B	CONTRACTS - YR 2	2DEC94	7JUL95
1001-99	COST PROPOSAL	18FEB94A	28MAR94A

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Figure 5.0-1

Project Schedule

Indian Mountain LRRS, Alaska

ACTIVITY ID	ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH
1002-01A	ALTERNATIVE DEVELOPMENT - YR 1	29JUL94	1DEC94
1002-01B	ALTERNATIVE DEVELOPMENT - YR 2	2DEC94	9FEB95
1003-01A	PREPARE ADVANCE DRAFT CONCEPTUAL SITE MODELS	5APR94A	12MAY94A
1003-01B	SUBMIT ADVANCE DRAFT CONCEPTUAL SITE MODELS	13MAY94A	13MAY94A
1003-01C	AIR FORCE REVIEW (CONCEPTUAL SITE MODEL)	16MAY94A	20MAY94A
1003-01D	PREPARE DRAFT CONCEPTUAL SITE MODELS	23MAY94A	2JUN94A
1003-01E	SUBMIT DRAFT CONCEPTUAL SITE MODELS	3JUN94A	3JUN94A
1003-01F	AIR FORCE/AGENCY REVIEW CONCEPTUAL SITE MODELS	6JUN94A	27JUN94A
1003-01G	PREPARE RESPONSE TO COMMENTS (CONCEP. SITE MDL)	28JUN94A	7JUL94
1003-01I	PREPARE FINAL CONCEPTUAL SITE MODELS	28JUN94A	21JUL94
1003-01H	SUBMIT RESPONSE TO COMMENTS (CONCEP. SITE MODEL)	8JUL94	8JUL94
1003-01J	SUBMIT FINAL CONCEPTUAL SITE MODELS	22JUL94	22JUL94
1003-04A	DEVELOP RI/FS REPORT - DRAFT YR 1	22SEP94	13DEC94
1003-04B	DEVELOP RI/FS REPORT - DRAFT YR 2	14DEC94	30JAN95
1003-04C	SUBMIT RI/FS REPORT - DRAFT	31JAN95	31JAN95
1003-04D	DEVELOP RI/FS REPORT - FINAL	7FEB95	28APR95
1003-04E	SUBMIT RI/FS REPORT - FINAL	1MAY95	1MAY95
1004-01A	ALTERNATIVE ANALYSIS - YR 1	22SEP94	13DEC94
1004-01B	ALTERNATIVE ANALYSIS - YR 2	14DEC94	22MAY95
1007-01A	DEVELOP DECISION DOCUMENT - DRAFT	21MAR95	19APR95
1007-01B	SUBMIT DECISION DOCUMENT - DRAFT	20APR95	20APR95
1007-01C	DEVELOP DECISION DOCUMENT - FINAL	27APR95	19JUN95
1007-01D	SUBMIT DECISION DOCUMENT - FINAL	20JUN95	20JUN95
1009-01	RI FIELD WORK	1JUL94A	28JUL94
1009-02	IRPIMS DATA MANAGEMENT	4AUG94	13DEC94
1009-03	ANALYTICAL DATA ITIR (CDRL A004)	22SEP94	13DEC94
1010-01	WORKSITE REQUIREMENTS	29MAR94A	2NOV94
1010-01A	EQUIPMENT STAGING	29MAR94A	2MAY94A

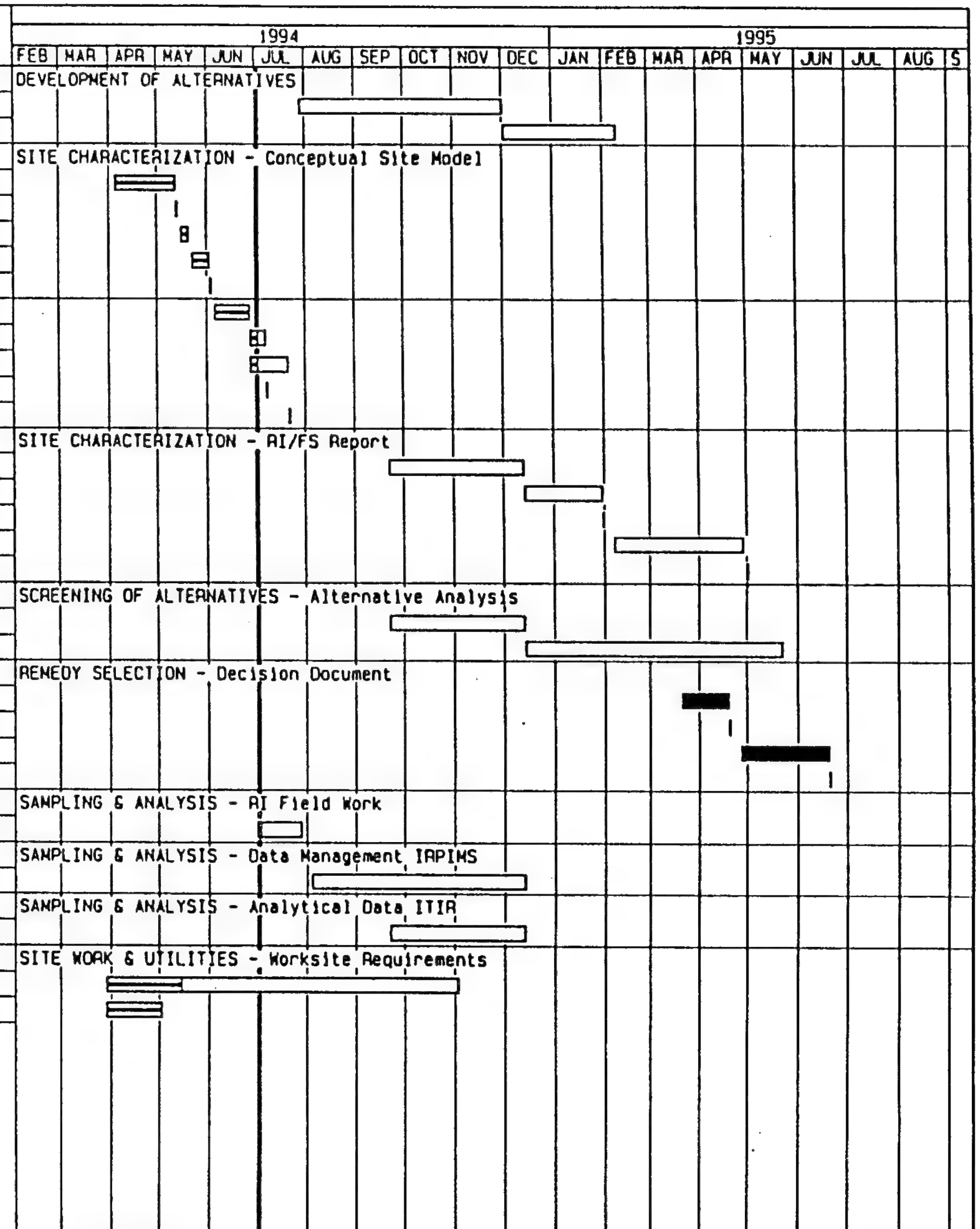

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Figure 5.0-1

Project Schedule

Indian Mountain LRRS, Alaska

6.0 REFERENCES

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